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THE VALIDITY OF CONTRACTS IN CASES OF RATE REGULATION.

In our LEGAL NOTES this week will be found a discussion of the question as to whether contracts made by a public-utility company prior to the regulation of its rates by a public-service commission should be regarded as inviolable when they come in conflict with the schedules of rates afterwards established by the commission. Mr. James V. Oxtoby, who is a prominent member of the Detroit bar, has considered several cases which have a bearing on this question, none of which, however, may be regarded as giving a final answer which would be applicable to all similar cases.

The federal constitution and the constitutions of most of the states contain provisions prohibiting the passing of legislation which may be regarded as invalidating the right of contract. This provision is of course always interpreted to include only those contracts which are regarded as legal and which do not contravene public policy. In cases where a contract, which has been unquestionably legal prior to the passage of a specific statute, is rendered illegal by the provisions of the latter, the courts have usually held that such contracts are no longer binding. In the case of contracts which come in conflict with rulings of a public-service commission, it would seem that the same principle would be the most logical to apply.

This has been done by the New York Public Service Commission, First District, in the case cited; whereas the Massachusetts Gas & Electric Light Commissioners seem to have taken an opposite view and considered themselves powerless to make a ruling which would come in conflict with the fulfillment of existing contracts. The latter position hardly seems tenable if one considers contracts for a very long term of years, or even in perpetuity, as such contracts might largely destroy the powers of such a commission in preventing discrimination amongst the various customers of a public utility, and this function of a commission is generally regarded as one of the most important which it exercises.

Whether it is desirable for a commission to exercise such a power, provided the courts decide that the power resides with it to nullify contracts which come in conflict with its prescribed schedules of rates, is another question. Mr. Oxtoby considers that in most cases it would be advisable to do so unless it were plainly evident that discrimination between cus-

tomers could not otherwise be avoided. Contracts for special rates are sometimes entered into in the way of experiment and in other cases with the idea of developing business. Where the rate specified in a special contract is not less than the cost of giving the service, it would seem reasonable to apply the same rate to all customers. The cost of giving service is here intended to cover, of course, all those elements which enter into the determination of a reasonable rate, including fixed charges, development expenses, etc. In cases where the rate is less than cost under the existing circumstances, but is not expected to remain so after business has developed to the anticipated point, there could still be no objection to making the same rate for all customers; the temporary loss from such customers being regarded as one of the expenses of developing the business. In cases, however, where the special rate is an obvious loss and cannot be justified along the lines suggested, it does not seem fair to the other customers that such a rate should be permitted to remain in force, since the loss occasioned by serving one customer below cost must be made up by charging other customers more than their share of the total expenses, providing the gross receipts of the company are to be such as to yield a reasonable rate of return upon the total investment. If the operating company were willing to forego part of the return upon its investment for the purpose of retaining such a special contract in force, it might seem at first as though there could be no objection upon the part of the other customers to such a rate, providing the discrimination were not such as to injuriously influence them in competitive lines of business. The willingness of company officials, however, to accept less than a reasonable rate of return on the investment, would seem to be in conflict with the interests of the investors in such a utility, and in safeguarding the interests of investors a commission might feel unjustified in permitting such a condition to exist. It must be remembered in this connection that one of the objects in establishing public-service commissions is not only to protect the consumer, but to protect the investor as well, and a commission cannot be expected to acquiesce in any practice which is inimical to the interests of either one.

It would, consequently, seem that in most cases which might come up in practice it would be proper either to require a rate which is already in force by private contract to be applied to all customers who might be qualified to be placed in the same class by reason of the consideration of their maximum demand, hours of use, total consumption of energy, etc., or else to nullify such contract at once and require such customers to be served upon the same terms as other customers of their class, thus avoiding discrimination. Special cases, however, might easily arise where such a general principle would not be considered applicable.

KELVIN MEMORIAL.

A movement is on foot to erect a memorial window in Westminster Abbey, London, to the memory of the late Lord Kelvin. This movement was started by the Institution of Civil Engineers of Great Britain, and a committee has been formed with representatives of the prominent engineering societies of Great Britain, Ireland, Canada, Australia, South Africa and the United States. Among the societies represented is the American Institute of Electrical Engineers, and its secretary, Mr. F. L. Hutchinson, has been designated to receive contributions from the members of the American Institute and others who are interested in participating in this tribute to one of the most distinguished men of science of a century.

William Thomson, who was afterwards made Baron Kelvin on account of his distinguished work in science and its practical applications, was born in Belfast, Ireland, on June 26, 1824. He died on December 17, 1907, in Scotland, where his residence had long been. In 1846, when only 22 years of age, he was made professor of natural philosophy in the University of Glasgow, and held that position for 53 years, attaining universal recognition as one of the greatest physicists of his time and making many contributions to the development of electrical science and its applications. Among his contributions to electrical development may be mentioned his investigations of cable telegraphy, and the invention of the syphon recorder; his investigations in thermo-electricity and the discovery of the Thomson effect; the invention of the Thomson double bridge for the accurate measurement of small resistances; the design of a variety of measuring instruments, including the Kelvin balance, the electrostatic voltmeter and the mirror galvanometer.

It is not alone, however, in the field of electricity that the work of Lord Kelvin was epoch-making. There is hardly any department of physics in which he did not do pioneer work. His calculations of the conduction of heat through the crust of the earth entirely altered the views of geologists in regard to the latter's formation, while his investigations of the nature of heat resulted in the proposal of an absolute scale of temperature and the second law of thermodynamics, and placed the dynamical theory of heat and the principle of conservation of energy in an unassailable position. He proposed the vortex-atom theory of the constitution of matter, and later showed that it would not suffice to explain all of the actual phenomena. His study of the tides and of the mariner's compass and his improvements in the latter are well known to students of these subjects.

No man of science, and particularly no worker in the field of electricity, is more deserving of the recognition of his fellow workers than is Lord Kelvin, and the request for contributions to the memorial fund should meet with a hearty response among all

classes of electrical workers. With the idea of making the movement as democratic as possible, the committee has suggested that contributions be limited to $10, and will welcome contributions of any amount, however small, hoping in this way to have a tribute to this great man participated in by everyone who has felt the benefits of his contributions to practical electricity.

WHAT DOES "MULTIPLE-SERIES" MEAN?

The question "What does multiple-series mean?" might seem at first sight a very simple one to anyone versed in a knowledge of electrical matters. As a matter of fact, however, opinions on this question differ and there seems to be no uniformity in the definitions given for the term "multiple-series" or its companion term "series-multiple."

Attention is called to an article in this issue by Mr. Z. C. Adams, municipal electrical inspector in Fort Worth, Tex. Mr. Adams discusses in his article the proper definitions for these terms and lays down a rule for very simply determining or remembering the appropriate designation to apply to any particular arrangements of circuits, according to the definitions which seem to him proper.

As stated above, there has heretofore been no uniformity in the general usage of these terms. Reference to the common English dictionaries shows at once a disagreement. The Century Dictionary does not recognize the term at all. The Standard Dictionary defines a multiple-series connection to be one in which a number of multiple groups are connected in series; whereas Webster's International Dictionary defines the same term as representing a number of series circuits connected in multiple. Turning to the dictionaries of electrical terms, we find Houston's Dictionary agrees with Webster, while Hobart's Dictionary of Electrical Engineering, which may, perhaps, be taken to better represent British practice, agrees with the Standard Dictionary. It may here be noted, however, that both Hobart's and Webster's Dictionaries admit of the use of the terms multiple-series and series-multiple as synonyms, and, indeed, they are used as synonyms by a great many persons. The usage among the authors of books on electrical and physical subjects is found to be in similar disagreement.

Since there are two distinct types of circuits which are to be represented by these terms, and since there are two terms in use for representing them, it seems very desirable that a distinction should be made between the meanings of "multiple-series" and "series-multiple," and that there should be uniformity of usage of the terms in correspondence to such definitions. Until authoritative definitions are laid down by some body whose jurisdiction in the matter will be recognized and whose recommendation will be generally followed, it will be difficult to secure any uniformity. The Committee on Terminology of the National Electric Light Association has generally avoided the definition of terms like these, and the Standards Committee of the American Institute of Electrical Engineers has never considered this particular case. It would seem as if the latter body might be an appropriate one to adopt a definition, and a proposal from this source would no doubt be generally followed. In the meantime the matter should be fully discussed and the pros and cons for the different designations that may be chosen should be fully considered.

The proposal of Mr. Adams is that the term "multiple-series" should represent a number of series groups which are connected in multiple. In other words the first portion of the compound term should represent the arrangement of groups and the second portion the arrangement of the elements within the group. It is a question in many minds whether it is not preferable to have the first term represent the arrangement within the group and the second term the arrangement of the groups, the latter being the natural inference of many persons upon first considering such a term. However, the matter is merely one of deciding upon a definition, and if there were one already in general usage it would be desirable to stick to it. As, however, previous usage has been very divergent, opportunity is afforded for adopting definitions which may have the most reasonable arguments to substantiate them. The columns of this journal will be open to suggestions from our readers as to which pair of definitions would be the most suitable for adoption, and it is to be hoped that there may be final uniformity upon this subject.

DIVERSITY-FACTOR.

While discussing the matter of terminology, it may be well to call attention to one of the definitions contained in the report of the Committee on Terminology of the National Electric Light Association, presented at the convention held this year at Seattle, Wash. Among a variety of terms which have been defined and which appear to have received a conscientious study by the members of the committee, is that of diversity-factor, which is defined as follows: "The ratio between the simultaneous demand of a number of individual services for a specified period, such as one hour, and the sum of the individual maximum demands of those services for the same period." While this definition seems desirable, inasmuch as the ratio specified will never be greater than unity and can thus conveniently be expresed as a per cent, it is to be noted that the term has heretofore been used to represent the reciprocal of this quantity, and care should be taken to avoid confusion in this matter. It would be well for all those using this term in the future to adhere to the practice which has been laid down by the committee and thus secure uniformity in use and obviate any misunderstandings which might otherwise arise.

Program of Pennsylvania Association.

As previously announced, the fifth annual convention of the Pennsylvania Electric Association will be held on Wednesday, Thursday and Friday, September 4 to 6, at the Bedford Springs Hotel, Bedford Springs, Pa. A number of attractive entertainment features have been arranged which will provide pleasant diversion during the hours not devoted to sessions.

An executive session will be held on Thursday afternoon, September 5. At the other sessions there will be reports by the Lamp Committee and the Committee on Overhead Line Construction, addresses by F. M. Tait and T. C. Martin, president and secretary of the National Electric Light Association, and the following papers will be presented: "The Schafer Prone Pressure Method of Resuscitation from Electric Shock," by C. A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company; "Power-Factor—Its Effect on Operation and a Means for Its Improvement," by F. N. Jewett; "The Wiring of Old Houses," by Messrs. McKirdy and Wood; "Welfare Work," by B. Frank Day; "Purchased Power—Its Advantages Versus Its Cost," by A. E. Rickards; "Dollars and Factors," by C. J. Russell; "Automatic Feeder Regulators for Outdoor Service as Applied to Single-Phase Lighting Circuits," by an engineer of the General Electric Company.

Service to Tenants of Flats.

The right of one public utility to serve tenants in an apartment house, the house itself being under contract for service from another utility, is the subject of debate in Louisville, Ky. In a clash between the Kentucky Electric Company and the Louisville Lighting Company in that city, a temporary restraining order against the latter concern has been allowed the former. The order of the Jefferson Circuit Court, in session under Judge James P. Gregory, is that the Louisville Lighting Company shall not enter with its wires an apartment building at 173 North Keats Avenue in Louisville, and that the company shall not interfere with the present connections of the Kentucky Electric Company in that building. This action is the result of a petition filed by the Kentucky Electric Company before Judge Gregory, setting forth that F. Schierich, the owner of the apartments, has contracted with it for lights in the hallways of the buildings, sub-contracts for tenant service to be subject to negotiation with private parties, and that the Louisville Lighting Company seeks to enter this property.

Negotiations for Lease of Power Plants Reported.

Negotiations are said to be under way for leasing the power plants of the Philadelphia (Pa.) Rapid Transit Company to the Philadelphia Electric Company as an extension of the contract which now exists between the companies. In July, 1911, the Philadelphia Rapid Transit Company entered into a five-year contract with the Philadelphia Electric Company covering the purchase of 8,000 kilowatts for delivery commencing in November, 1911. This contract was subsequently extended to cover a ten-year period and increased from 8,000 to 15,000 kilowatts, commencing November 15, 1912, and to 20,000 kilowatts commencing November 15, 1913. Contracts with the Philadelphia Electric companies operating in Delaware County were increased from 560 kilowatts to 1,200 kilowatts effective on October 1, 1912. A new contract was also entered into recently with the Philadelphia Electric Company for the supply of 5,000 kilowatts to the Philadelphia Rapid Transit Company in the northern district, including Chestnut Hill, Ogontz, Willow Grove and Neshaminy, for ten years commencing June 1, 1913.

Schenectady Section Elects Officers.

The annual election of the Schenectady Section of the American Institute of Electrical Engineers has resulted in the choice of the following officers: honorary chairman, C. P. Steinmetz; chairman, J. B. Taylor; vice-chairmen, J. L. Burnham, H. W. Peck and C. N. Davis; secretary, J. A. Dewhurst; treasurer, W. S. Bralley; managers, G. H. Reid, W. S. Clark, J. J. Linebaugh and C. Lichtenberg.

Flood Damage at Merrill.

The damage to the property of the Merrill Railway & Lighting Company, Merrill, Wis., in the flood of July 25, 1912, will not exceed $10,000. The dam at Merrill is of wood construction, 400 feet long. A canal passes through the dam with retaining walls on each side. The river side of one of these retaining walls has flood gates 7 feet deep. The main dam has gates 6 feet to 12 feet deep clear across. The spillway for floods is about 3,200 square feet. Previous to the flood of July 25 the company was able to keep the water in the pond at normal height. The power house is on the side of the canal away from the river. This millpond and embankment were built in 1848, and the embankment never overflowed before. Twenty-four hours previous to the damage 11.25 inches of rain fell in Merrill. The storm was equally severe 20 miles above and below this point. At the height of the flood an unattended closed water power two miles above the one of the Merrill Railway & Lighting Company cut around its dam and emptied its pond upon that of the Merrill Company, and it was the failure to open up the gates of this dam earlier that caused the damage at Merrill.

Insurance for Telephone Employees.

An insurance system for employees of the American Telephone & Telegraph Company and the Western Union Telegraph Company is being planned by the officials of those companies. This will take the form either of life insurance, payable in case of death, or of disability insurance, payable temporarily in case of illness or accident. A referendum is being taken among the employees as to which form of relief would be preferred.

The Coal Resources of Wyoming.

The United States Geological Survey estimates the quantity of coal in the ground in Wyoming as exceeding that of any other State in the Union, with the possible exception of North Dakota.

Wyoming is the second largest coal-producing State in the Rocky Mountain region, Colorado ranking first; and if production in Wyoming continues to increase within the next few years as it has done in the last 25 it will soon rival Colorado for the first place. The coal mined in Wyoming is bituminuos and subbituminous.

Automatic Telephony in England.

Automatic telephony is to be tried out in England by the post office. An order has been placed for a 10,000-line exchange which is to be installed at Leeds. This will be the first experiment on a large scale. Small automatic exchanges are already in operation at two small towns.

Meeting of Cotton Manufacturers.

The semi-annual meeting of the National Association of Cotton Manufacturers will be held at the Griswold, New London, Conn., September 9 to 11. The secretary of this association is C. J. H. Woodbury, 45 Milk Street, Boston, Mass.

The Madison River Power Company has just installed a 250-horsepower motor in the plant of the Bozeman Milling Company, Bozeman, Mont. This installation is rather notable, inasmuch as the business was secured in competition with the milling company's own water power. W. W. Livingston is manager of the company.

H. G. Stott.

In any scanning of events in electrical and mechanical engineering and the development of centralized power production of great magnitude of the last twenty years, the figure of H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, New York City, looms up as a sturdy and impressive personality. H. G. Stott is a big man physically, and his ability a..d accomplishments are in keeping with these proportions.

Henry Gordon Stott is a Scotchman by birth, the son of the Reverend D. Stott, born in the Orkney Islands in the extreme northern part of Scotland His early education was under the direction principally of his father and at the Watson College School in Edinburgh. He also studied at the College of Science and Arts at Glasgow, devoting himself particularly to engineering, electricity and chemistry. His first occupation in electrical engineering work was with a small electric light company in Glasgow, in October, 1884.

In May, 1885, he became assistant electrician to the Anglo-American Telegraph & Cable Company, holding this position until October, 1889. During this connection he devoted a great deal of time to research work on the self-inductance of iron-armored submarine cables, developing new methods for the locating of faults. He was the first to successfully duplex the main cable of the Direct United States Cable Company, receiving special recognition from the organization for this service.

He left the telegraph field in 1889, and accepted a position with the Brush Electrical Engineering Company, located at that time at Bournemouth, England. He spent a year there as assistant engineer in the lighting plant, and then went to Madrid, Spain, where he assisted in the erection of engines, generators, the underground system, and the wiring of many installations in that country. He returned to the Brush Electrical Engineering Company in London, and became associated with the general engineering staff as assistant to the chief engineer.

Mr. Stott came to America in September, 1891, and almost immediately was engaged by C. R. Huntley, of Buffalo, N. Y., to install the first underground-cable system in that city for the use of lighting and power. He spent several years in the construction and engineering departments of the Buffalo General Electric Company, and had under his direct supervision the reorganization of this plant, the consolidation of its power houses, and the redesigning of its entire system of generation and distribution.

After nine and one-half years of service with the Buffalo General Electric Company, Mr. Stott accepted the position of superintendent of motive power of the Manhattan Railway Company of New York City, taking charge of its new 70,000-horsepower generating plant and seven substations, as well as its entire distributing system. At this time this was one of the greatest engineering installations in the country.

H. G. Stott,
Superintendent of Motive Power, Interborough Rapid Transit Company.

When the great stations of the Interborough Rapid Transit Company were planned, Mr. Stott was chosen as superintendent of motive power, having under his direct supervision over 150,000 horsepower, including substations and the immense distribution system.

Mr. Stott is a past-president of the American Institute of Electrical Engineers, and it was in 1908, during his administration, that the great public-service dinner of the Institute was held. This was considered one of the most notable and interesting functions ever held by the Institute.

Byllesby Company Assumes Management of Minneapolis General Electric.

Active management of the Minneapolis General Electric Company, which was purchased from Stone & Webster sometime ago, was assumed August 1 by H. M. Byllesby & Company. Vice-President Arthur S. Huey personally superintended the transfer. George H. Harries, president of the Louisville Gas Company, and vice-president of the Consumers Power Company and of the Minneapolis General Electric Company, has been assigned general supervision over the property. Samuel Kahn took charge as acting manager temporarily. Mr. Huey announced that the company would proceed to develop 35,000 horsepower on the St. Croix River above the present 20,000-horsepower development at Taylor's Falls. He stated also that the company contemplates further water-power development on the Mississippi River, amounting to approximately 80,000 horsepower, which would give a total of not less than 160,000 hydroelectric horsepower, including several smaller developments, available to Minneapolis and St. Paul and vicinity. The properties at Minneapolis and St. Paul will be connected by transmission lines and the water powers of the Consumers Power Company at Cannon Falls and Mankato also will be tied in by a transmission line running south from St. Paul.

The Minneapolis General Electric Company, under Stone & Webster's management, has been known as a splendidly constructed and progressively managed central-station company. In January, 1912, the company had 16,245 customers with a total connected load of 62,245 horsepower. There were 429 employees.

Business and plant have had great expansion during the past seven years. At the present time the company has installed 22,500 hydroelectric horsepower and 16,500 steam horsepower the latter being in a recently constructed station of the most modern and efficient design. Five thousand additional horsepower will be added to the present development at Taylor's Falls. In spite of the great increase in business during the past few years, much additional service can be marketed within a short time.

Meeting of California Contractors.

The California State Association of Electrical Contractors held a meeting at San Jose, Cal., July 24 to 28. The attendance was 250. Business sessions were held on Wednesday morning and Thursday morning at San Jose; on Thursday afternoon at Palo Alto, and on Friday at San Jose.

The meeting of Friday was opened with C. F. Butte, chairman of the Committee on Instructive Papers, in the chair. Secretary W. S. Hanbridge read a paper entitled "Observations of the Contractor from the Secretary's Office." H. V. MacMeans discussed the subject of "Liability Insurance." The next paper was by Milton Wise on "The Development of the Electrical Business." A history of the National Electrical Code was given by C. W. Mitchell, of the Board of Fire Underwriters.

George Holberton, of the Pacific Gas & Electric Company, then spoke on "What the Contractor Should Know About Central Stations." This address was illustrated by over 150 lantern slides, showing the development work and power house of the company, which supplies two-thirds of the counties in California.

Tracy E. Bibbins read a paper showing how the manufacturer and contractor could work together to build up the electrical business. Charles Hillis then spoke on "The Evils of the Contracting Business and the Way to Correct Them, From the Eyes of the Jobber." The final paper was by Albert Elliott, secretary of the Pacific Coast Jobbers' Association. It was entitled "Co-Operation of the Electrical Trades."

A report was then presented by the Jobbers' Committee, who had been in session with a committee from the Pacific Coast Jobbers' Association. The Committee report was received and the Committee instructed to keep at work along the same lines. The following officers were then elected: President, J. C. Rendler, of Los Angeles; first vice-president, C. V. Schneider, of Sacramento; second vice-president, J. S. Reynolds, of Santa Barbara; secretary-treasurer, W. S. Hanbridge, of San Francisco; Sergeant-at-Arms, R. L. Booth, of Los Angeles.

On Wednesday afternoon an automobile trip was taken through the beautiful orchards and foot hills of Santa Clara Valley. In the evening a moving-picture exhibition was given in the St. James Hotel by the General Electric Company and Westinghouse Electric & Manufacturing Company, after which there was dancing.

On Thursday a special train was taken to Palo Alto, where a visit was made to Stanford University, and luncheon was served by the Palo Alto Chamber of Commerce. In the evening there was a theater party.

On Friday evening the annual dinner was held in the ball room of the St. James Hotel. A large sign "Welcome" took up the entire front wall, while on the center table there was a miniature electric tower about 10 feet high. The room was beautifully decorated with flags and flowers and an entertainment was provided during the dinner, after which the tables were removed and dancing followed.

Saturday was Electric Trades Day, and special cars took the party to Luna Park, where atheletic events were held, for which prizes were given. A baseball game was played in the morning between the Northern and Southern contractors, which was won by the former with a score of 12 to 6. In the afternoon a game was played between the contractors and the jobbers. The jobbers won by a score of 20 to 11 and were presented with a very fine cup.

On Saturday evening there was a rejuvenation of the Sons of Jove, the first which has been held in California for over four years. Forty candidates were initiated. The rejuvenation was in charge of Tracy E. Bibbins, in the absence of Statesman Sanderson.

An organization of the electrical inspectors of the state was formed during this convention, as noted in our last issue.

Some Data on the Amount of Energy Required for Electroculture.

Exact measurements of the amount of energy used in electroculture have been made by Max Breslauer. In his experiments, which were carried on in conjunction with the German Society of Agriculture, near Potsdam, 60,000 square meters were covered with a network of wires consisting of tinned steel 0.8 millimeter in diameter, suspended 4 to 5 meters above ground at a distance of 10 meters from each other. This wire net was charged positively, while the negative pole of the current source was connected to the ground. The measuring arrangement consisted of a very sensitive moving-coil ammeter inserted in the ground connection. The tension could be measured only by the aid of a spark gap in free air, which, as is well known, corresponds to a tension of about 3,000 volts per millimeter with spheres 25 millimeters in diameter. In dry, not too hot weather the instrument showed a deflection of 61 scale divisions with the entire net in circuit, and 41 scale divisions with half the net in circuit, each scale division representing 7.6×10^{4} amperes. Taking into consideration a shunt, which reduced the sensitiveness of the instrument to about one-tenth, the current employed for one-half of the net was 0.385 milliamperes, for the entire net 0.51 milliamperes. The spark length varied between 20 and 25 millimeters, and the average tension, therefore, was 65,000 volts. The fact that the currents are not as 1.2 shows that strong radiations probably take place in the neighborhood of the apparatus and from the conductor leading to the net. Twice the difference between the two measurements, namely, 0.26 milliamperes, must therefore be considered as the energy actually radiated by the net for the entire 60,000 square meters. Thus the power was 17 watts, or 0.28×10^{3} watts per square meter. According to meteorological observations made near Potsdam during 1908, the current intensity thus artificially produced is one thousand to ten thousand times greater than that furnished by nature, and should therefore be sufficient to produce perceptible effects, if any influence on the vegetation is exerted at all.—*Zeitschrift für Elektrochemie.*

City Planning Congress at Düsseldorf.

Düsseldorf, a most beautiful and modern city in western Germany, known as the "Park City," and the center of the industrial empire, with its extraordinary commercial and political developments, is at present holding an Exhibition on City Planning, City Operation and City Administrative Functions.

The exhibition extends from June 29 to October 31, while the International Congress will be from September 23 to 28.

The first group of exhibits consists of general ground plans, traffic systems, such as railways, local and express facilities, elevated, subway, suspension and street railways, aviation stations, city embellishment, bridges, docks, parks, lawns, forests, etc.

Under City Operation are grouped gas works, water works, electric central stations, sewage systems, street cleaning, refuse disposal, cemeteries, etc.

Under the third group are exhibited plans and models of hospitals, rescue homes, poor houses, asylums, schools, churches, libraries, etc.

Use of Electricity in the Disinfection of Swiming Baths.

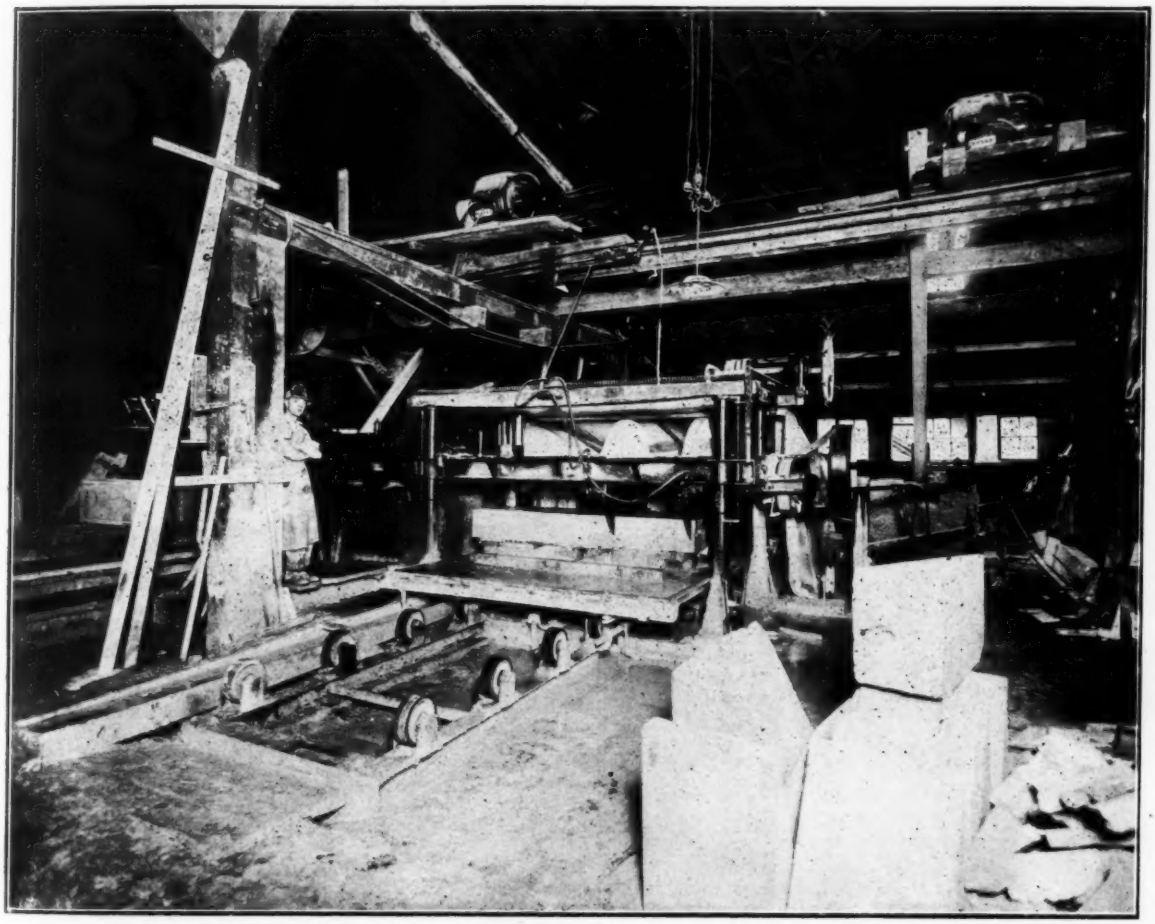
In a report to the council of one of the English boroughs, the Committee on Public Health calls attention, says *Electricity*, to the findings of J. Graham Forbes in connection with Dr. Alexander's system of purifying by means of electrolytic disinfectant. The general application of this system to public swimming baths and to those built for the use of the public schools is advocated.

Electricity in Stone-Cutting Plants.

The remarkable improvements that have been made in stone-cutting plants due to the adoption of electric drive insures the ultimate equipping of all such plants with motors. This article points out the opportunities for the sale of power in this industry and presents operating data on numerous plants.

Sandstone, because of the ease with which it is cut and made ready for use, is required in great quantities for building purposes. With the possible exception of the ordinary brick, more of this stone than any other is used throughout the country each year.

The great oolitic quarries for which this country is famous are situated near Bedford, Ind., and from these beds, great quantities of the stone are taken each year. In this stone-cutting industry as in many others, electricity as a motive power is rapidly displacing the methods of only a few years ago.



Double Diamond Disk Saws Operated by 15-Horsepower Motor. John Tait Stone Company, Chicago.

It was hardly more than 30 years ago that almost all cutting was done by hand. Cumbersome machinery was used to cut and free the stone from the quarry beds. It was then taken to adjoining yards and roughly cut into blocks of standard sizes, and shipped out to the dealers in all parts of the country. At about this time brownstone was very popular with city builders, and great quantities were used.

It was not until steam-driven machinery came into general use that any great architectural change appeared, for with machinery there followed a greater variety in stone cutting. For many years steam was the only power employed by the stone cutters; recently, however, it has been superseded by electricity at the quarries, and concurrently the stone cutters and contractors have adopted the latter for their work.

What is true of power development in the sandstone and limestone industries is also true of marble, granite, etc., and while this article will be limited to a discussion of the opportunities for central-station power in stone-cutting plants only, a brief account of quarrying methods may prove of interest.

The initial move in freeing stone from the quarry consists of stripping the soil and soft surface rock from the oolite bed. This is usually done by hydraulic pressure. A hard rock covering is then blasted away. Deep slots, varying from 8 to 18 feet in depth, are then cut in the stone. This operation is called channeling, the tool consisting of a steel rod with an 18-inch stroke, which is raised and lowered at the rate of 180 times a minute, advancing meanwhile across the face of the rock. A 12-horsepower motor, operated by one man, is used with the channeler, while the old steam channeler required the services of three laborers.

The blocks formed by the channeler are loosened by a sidewise pull of a derrick crane, and are lifted out to the

stone pile. Weather conditions permit of but 8 or 9 months' work in the quarry, but in this time enough stone is taken out to keep the mills busy the entire year.

In the mill yards the stone is handled by traveling cranes of from 10 to 30 horsepower. Here the blocks are sawed to slabs of varying size and thickness, the saws used being of different types, some circular and some straight. Generally the teeth are set with diamonds, but occasionally they get their biting surface from quartz and water which is fed under the blade. From the mills the stone is shipped to dealers where all cutting and special work is done.

While the stone fields, supplying the greater portion of the stone and marble used in this country are more or less restricted to certain territories, as in the Bedford district, the converse is true of the cutting plants for finishing the stone, these being very widely scattered. There is hardly a town of any size that does not count an establishment of this character among its industries. While the load-factor of these plants is rather low, the work at times being intermittent, the business is very profitable to central stations, particularly in the summer months.

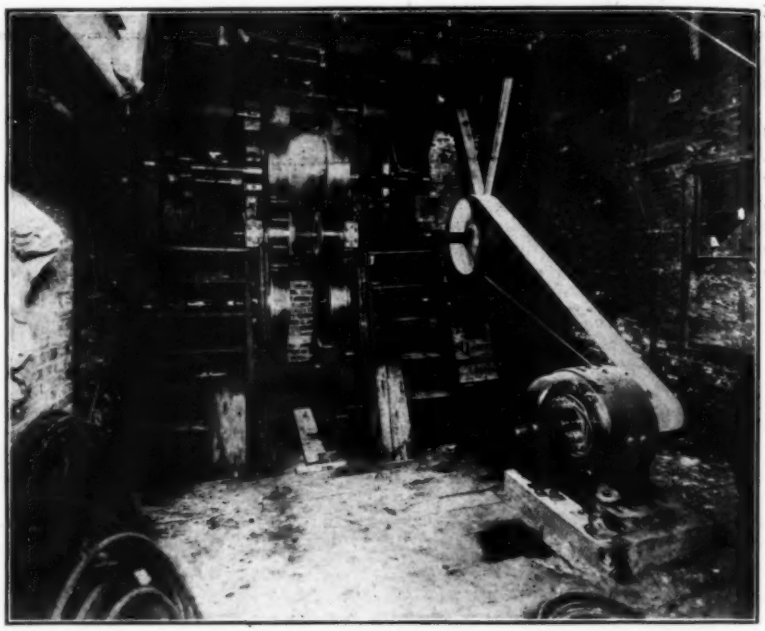
The rugged construction of electric motors, their simplicity and their ability to withstand hard usage and operate continuously under disadvantageous conditions make them particularly adapted for driving stone-cutting machines.

In such plants, also, the machines are usually scattered over considerable ground area. Mechanical transmission requiring long lines of shafting, innumerable belts of all sizes and other mechanical appliances, the continuous operation of which, for the delivery of small quantities of power at points remotely located with relation to the main engine room, or long lines of steam piping for the delivery of steam into engines located in the outlying departments, are sources of constant loss, continuing throughout all hours of operation.

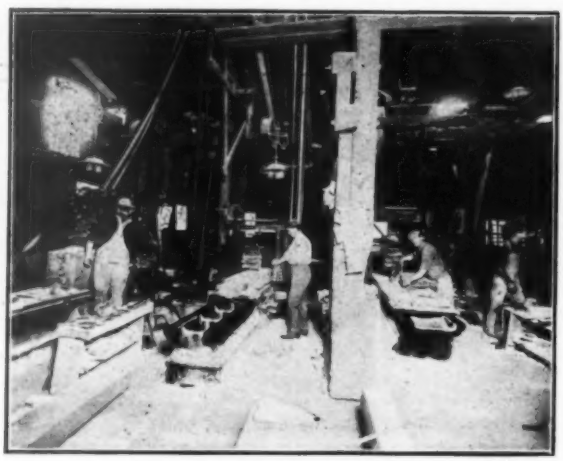
The steam plant of a stone-cutting establishment is, in most cases, an exceptionally inefficient one, operating under adverse conditions and with great losses. The buildings are more or less temporary and in their construction practically no attention is given to such items as economy in handling fuel and ashes, draft for furnaces, steam piping, etc. Machinery is usually of an inexpensive and inefficient character and as a result enormous amounts must continually be spent for repairs.

The loss of energy in the mechanical driving of stone-cutting plants, due to friction, is rarely ever known. The difference between the indicated horsepower of the engine when operating the plant with machines loaded and when operated with machines idle is commonly taken as the total friction load. As a matter of fact the friction losses increase with the load, sometimes being three times, and usually at least twice the no-load friction losses. When these conditions are figured on a basis of dollars and cents, and then compared with the cost of installing motors there certainly should be no difficulty in securing the business of stone-cutting plants.

The following description of a stone-cutting plant, handling marble particularly, contains data of considerable in-



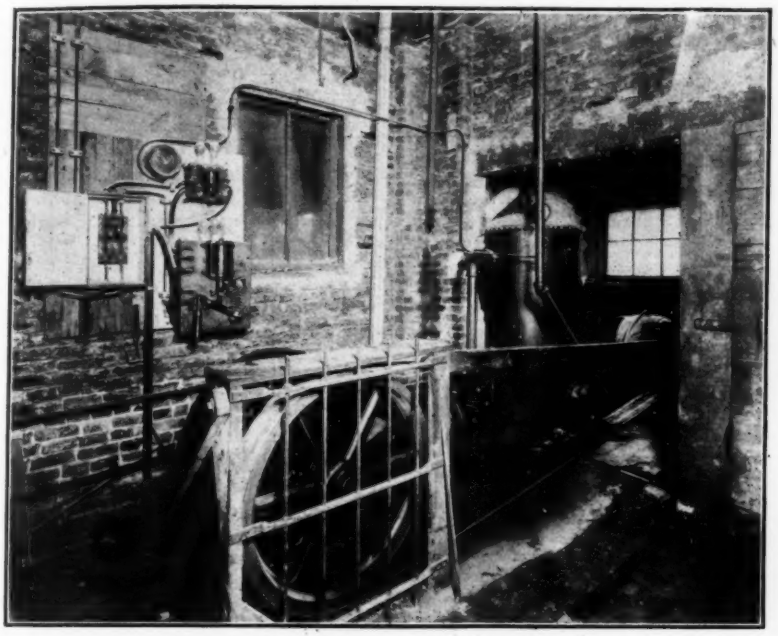
Motor Belted to Winding Drums of Two Derricks. John Tait Stone Company.



Group of Motor-Operated Planers.

Five-Ton Electric Crane.

terest and importance. The plant, as originally equipped, consisted of a 100-horsepower Atlas simple slide-value engine belted to a five-inch line shaft with a multitude of countershafts and tight and loose pulleys. It was found on test that to run this shafting required



Air Compressor Driven by 20-Horsepower Motor.

35 horsepower with the machines running idle. Under the old system, the drive was very cumbersome and complicated; the multiplicity of belts and their location made it positively dangerous to move around in certain parts of the plant.

Owing to the fact that some of the machines required about three times normal running torque in order to get them under way, there was a great deal of trouble experienced in maintaining the speeds of the different machines, and considerable expense and trouble was caused by belts being thrown off and machines shut down until the belts could be repaired.

The plant at present contains about 30 induction motors, varying in size from 5 to 20 horsepower, three-phase, 220 volts. A description of the various machines in this plant will give some idea as to the work to be accomplished and information as to the power required.

Motor Belted to Driving Mechanism of Gang Saw.

Motor-Driven Planer.

Rub beds are used to grind the edges on slabs and blocks of marble down to a true surface, after they have been rough chipped by hand or sawed into slabs. They consist of very heavy cast-iron disks made in sections and varying in diameter from 9 to 14 feet. The disks are 6 to 8 inches in thickness and weigh several tons each. In this particular installation there are installed: Three rub beds, 11 feet in diameter; one rub bed, 9 feet in diameter; and two rub beds, 14 feet in diameter.

The 11-foot rub beds are driven by 10-horsepower induction motors, three-phase, 60 cycle; the 9-foot rub bed is driven by a 7.5-horsepower motor; and the 14-foot rub bed is driven by a 15-horsepower motor. The 9 and 11-foot machines are attached to a heavy upright shaft about six inches in diameter, supported at both top and bottom.

When the old belt drive was used, it was necessary to call upon a number of laborers to assist in starting these machines, and as this had to be done twice each day, considerable time was consumed, largely because it was necessary to shift the belt from the loose to the tight pulley a little at a time, on account of the danger of breaking or burning the belt.

With the electric drive it is only necessary to operate the auto-starter in order to start the rub beds, and this is done by any laborer at the machine. Furthermore when the electric drive was installed, the rim speed was increased from 1,300 to 1,650 feet per minute, and it was found that the electric drive resulted in an increase in the output of the machines of approximately 33.33 per cent.

Gang saws consist of rectangular iron frames, about six feet by 12 feet, into which are set on edge in parallel rows flat strips of steel three inches wide, one-eighth inch thick and about 12 feet long. These strips of steel are used for cutting rough blocks into slabs of any desired thickness. They have no cutting edge, the cutting being due to abrasion. The number of saws in any frame depends upon the size of the blocks and the thickness of the different slabs desired, and varies from 12 to 60. The saws are stroked back

and forth across the marble block about 90 times per minute, and mixed sand and water is poured upon them in a constant stream. The horizontal travel of the saws is approximately 20 inches and the rate at which the saws are fed into the block is dependent upon the stone being cut. This feeding is accomplished by means of a ratchet and pawl arrangement.

The particular plant under consideration contains 8 sets of gang saws, 6 of which are driven by a 7.5-horsepower induction motor each, the others requiring 10-horsepower motors. The motors are connected by means of a raw-hide pinion meshing into a cut gear.

It was found necessary, in order to obtain a steady speed, to place a five-foot flywheel, with a very heavy rim, on the main driving shaft. Before this flywheel was used, it was found that the motor bearings were subjected to a very undesirable shock. The difficulty, however, has been obviated, by means of the flywheel, very satisfactorily.

A peculiarity of this drive is that, after the saws are once started, they are in continuous operation until the block is sawed through, an operation that frequently consumes several days and nights when sawing marble.

This part of the plant was formerly a mass of moving belts, some of them being so located as to make it a dangerous place, but since the introduction of the electric drive and the elimination of all belting and overhead shafting, there is ample space for all the drives and absolute comfort and safety for the operators.

The speed at which these saws run at the present time is somewhat greater than obtained when the belt drive was used. The increase in production has been about 10 per cent; and a much more steady and satisfactory drive has resulted.

Polishing and buffing machines are divided into two classes; one kind being used to grind down the surface of the slab by means of a flat iron disk 20 inches in diameter, into which are fitted sections of emery stone; while the second kind has a flat iron disk on the surface of which felt is stretched. A five-horsepower motor with a speed of 1,700 revolutions per minute, arranged for wall suspension, is fastened to an upright post. The motor is connected by means of beveled gears to a vertical shaft on a double swinging bracket arm. From this shaft, by means of belts, the grinding disk is connected. The grinding disk, which in this case is 20 inches in diameter, revolves at a speed of 500 turns per minute. From the above it is evident that the machines are capable of being swung in any direction horizontally. They extend about five feet from the wall and have a swing equivalent to this extension over about half a circle. They are capable of polishing a slab of any size up to 10 feet in width. Where the emery blocks are used, a constant stream of water is poured on the marble slab, but when the felt polishing wheels are in operation a compound is used.

The polishing or grinding wheels of these machines can be raised or lowered by the operator, the shaft having a long keyway which allows it to be raised or lowered in a vertical direction without affecting the position of the driving pulley.

These machines are connected directly on the line, that is, they have no auto-starters. The starting operation consists simply in closing a three-pole switch. It is, however, in starting these machines, necessary to raise the grinding or polishing disk from the surface of the stone, but as the switches are directly in front of the operator, this is easily accomplished.

On a test, with the old belt drive, it was found that these machines took 3.5 horsepower running idle and about eight horsepower when operating. Since the direct drive has been applied, however, it is found that a five-horsepower motor is ample for the operation of the polishing machines. In this particular plant there are nine of these machines in operation, and it is found that the output of the machines, since the adoption of electric drive, has been increased 100 per cent.

Miscellaneous machinery.—There is in one part of this plant a 15-horsepower motor, driving three lathes used for turning large marble columns, three planers used for cutting grooves in stone, an emery wheel and a stone crusher. There is also one 7.5-horsepower motor belted to a large double planer used for cutting grooves, and also a 15-horsepower motor belted to a line shaft driving a group of routing machines which are used to countersink slabs. There is also a five-horsepower motor geared to a cross-cut saw, which consists of a single steel strip about four inches in width by one-eighth inch thick, supported by a wooden frame, which operates in a manner similar to the gang saws already described. In addition there is also a five-horsepower motor belted to a line shaft driving the machine shop, which is necessary to keep the machines in repair.

Since the change to electric drive, each of the various machines travels at the speed best adapted for maximum production; dangerous belting has been entirely removed; the company is more certain as to what its production will be than under the old drive; the deliveries have become materially better and the company is now able to make shipments in less time than its competitors using the old drive. The production has increased in the various departments from 10 to 100 per cent.

Tests of Horsepower Required.

The installation in which the following tests of power required to operate marble and stone-polishing wheels were made consists of a "bed" wheel 12 feet in diameter, 4 inches thick and weighing 8.5 tons which is mounted on a vertical shaft, the lower end of which rests on a ball bearing. This bed wheel is supplied with water and sand of varying degrees of fineness, depending on the work to be done. It is rotated at a speed of 34 revolutions per minute. The slabs of marble, slate or soapstone to be worked are supported on this bed wheel by means of a wooden frame, in such a manner as to grind or polish, as required. A 15-horsepower 220-volt direct-current motor, operating at 1,125 revolutions per minute, was connected through a nine-inch belt to a 48-inch pulley mounted on a countershaft 19 feet distant. The speed of the countershaft was 230 revolutions per minute. From the countershaft a drum pulley, 18 inches in diameter and 24-inch face, transmitted power through a 10-inch belt to a fast pulley, 48 inches in diameter by 12-inch face, which is mounted next to a loose pulley of similar diameter and face on a shaft seven feet away. This shaft has a speed of 86 revolutions per minute and transmits power to a vertical shaft supplying the bed wheel through a pair of bevel gears, 20 by 50 teeth. Between 3 to 5 minutes are required to bring the bed wheel up to speed. When the bed wheel is to be used, the motor is started on a countershaft operated at full speed, and the shift is then carefully thrown over. When starting the bed wheel, the power required is 18 horsepower. At full speed running idle, the bed wheel requires 4.5 horsepower. With the heaviest load of polishing and grinding that could be obtained, seven horsepower was required to operate the wheel.

Horsepowers required by other machines are given in the accompanying table:

	Horsepower
12-inch polishing stone or rub bed.	10
47-inch circular stone saw.....	5
60-inch circular stone saw.....	7.5
Stone planer	5
6-blade stone saw.....	15
Rip saws .....7.5 to 10	
Single-platen planers, 3 feet wide..	5
Single-platen planers, 3 to 5 feet wide	7.5
Single-platen planers, 5 to 8 feet wide	10
Double-platen planers, 6 feet wide..	12.5
Gang saws, swing type.....10 to 15	
Straight-cut type .....15 to 25	
Diamond saws—single platen.....	25
Diamond saws—double platen.....	30

(*Continued on page 301*)

Stone-Cutting Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rate capacity of the motors for the running hours per day specified for each installation.

John Tait Stone Company, Chicago. This company furnishes stone for building purposes and has a daily output of about 35 tons a day, most of which is only sawed and planed, though some carving is done. Bedford stone is used, principally. Combination drive. Running hours per week, 54.

Total connected horsepower, 149.5. Total number of motors installed, 14. Average kilowatt-hours per month, 8,041.

Kilowatt-hour consumption for 12 months: January, 6,408; February, 6,072; March, 8,180; April, 8,352; May, 10,632; June, 6,864; July, 6,696; August, 8,568; September, 8,928; October, 7,992; November, 8,496; December, 9,310.

Load-factor, 9.7 per cent; operating-time load-factor, 30.4 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	625	Shunt-wound motor belted to 14-blade gang saw, cuts stone to 12 ft. long.
1	7.5	650	Shunt-wound motor belted to 12-blade gang saw, cuts stone up to 10 feet long.
1	20	925	Shunt-wound motor belted to drums of one 20-ton and one 12-ton derrick. (Used separately.)
1	15	800	Belted direct to an 8 by 8 air compressor delivering air at 75 pounds pressure. Manufactured by Chicago Pneumatic Tool Company.
1	15	625	Belted to countershaft driving double-disk diamond saw, saws 44 inches diameter.
1	15	625	Belted to countershaft of Anderson single diamond saw, 62 inches diameter.
1	20	925	Belted to countershaft of double planer, takes stone up to 10 feet in length.
1	10	1,250	Belted to countershaft of Lincoln Iron Works single planer, size of stone 12 feet long by 3 feet wide.
2	5	1,100	Belted to shaft driving two single planers, one taking stone 7 feet in length, and one 10 feet.
2	5	1,100	Series-wound motors direct connected to mechanism of two five-ton cranes.
1	2	1,200	Belted direct to double emery wheel, 10 inches diameter.
1	15	925	Belted direct to centrifugal pump supplying water to gang saws and mill.

Energy is supplied by the Commonwealth Edison Company.

Building stone plant having a monthly output of about 10,000 cubic feet of limestone cut and planed for building purposes. Combination drive. Running hours per week, 60.

Total connected horsepower, 219.5. Number of motors, 9. Average kilowatt-hours per month, 20,825.

Kilowatt-hour consumption for 4 months: April, 19,000; May, 20,800; June, 22,200; July, 21,300.

Load-factor, 17.4 per cent; operating-time load-factor, 48.8 per cent.

The electrical energy consumption per cubic foot of stone cut and planed is about 2.1 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power,	Speed R. P. M.	Application.
1	25	850	Squirrel-cage motor geared to a Sullivan Machinery Company 9-inch by 9-inch by 12-inch air compressor, 80 pounds pressure, furnishing about 127 cubic feet of air per minute to eight three-fourths inch pneumatic hammers; eight one-inch pneumatic hammers; one light carving hammer; three rock drills; one pump; one small hoist; one Erie Foundry Company No. 369 forge hammer and one forge blower.
1	60	1,120	Squirrel-cage motor belted to a 100-foot line shaft and a 40-foot countershaft driving one 6-foot by 17-foot stone-cutting lathe; two New Albany Manufacturing Company6½-foot by 3½-foot by 15-foot, 4-head planers; one New Albany 7.5 by 3.5 by 15-foot 4-head planer; one Lincoln Iron Works 5 by 3.5 by 14-foot 4-head planer; one New Albany stationary bed, double-column planer; one Smith & Miller 20-inch shaper; one 24-inch by 10-foot lathe; one 12-inch drill; one automatic planer-knife grinder; one double 10-inch emery wheel.
1	20	850	Squirrel-cage motor belted to an Anderson 6-foot diamond disk saw, 600 revolutions per minute.
1	7.5	850	Squirrel-cage motor belted to feeding mechanism of above saw.
1	50	850	Squirrel-cage motor belted to a 55-kilowatt, 125-volt compound-wound direct-current generator, supplying current to the following machines:
1	15	1,200	Shunt-wound motor geared to a 56-inch W. F. Meyers diamond saw, 740 revolutions per minute.
1	25		Series-wound motor operates a New Albany 25-ton crane.
1	10		Series-wound motor operates a New Albany 15-ton crane.
1	7		Series-wound motor operates a New Albany 7-ton crane.

Stone-Cutting Data—Sheet No. 2.

Stone-cutting plant, located in Chicago, making tombstones and monuments exclusively. Combination drive. Running hours per week, 54.

Total connected horsepower, 17. Total number of motors installed, 3. Average kilowatt-hours per month, 1,093. Kilowatt-hour consumption for 12 months: January, 972; February, 741; March, 1,029; April, 1,145; May, 1,257; June, 912; July, 1,005; August, 1,009; September, 1,155; October, 1,190; November, 1,372; December, 1,338. Load-factor, 11.9 per cent; operating-time load-factor, 35.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycle, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power,	Speed R. P. M.	Application.
1	10	1,120	Belted to a 12-foot shaft driving one Chicago Pneumatic Tool Company 6 by 6-inch air compressor, operating at 35 pounds pressure; and one Chicago Pneumatic Tool Company 8 by 8-inch air compressor operating at 70 pounds pressure. These compressors supply air to one surface polisher, three seven-eighths inch tools and one pug drill.
1	5	1,700	Belted to an 8-foot shaft driving a Smith, Whitcomb & Cook No. 2 surface polishing machine, with a 22-inch diameter maximum tool, and a 9-foot flexible arm.
1	2	1,700	Belted to a 15-foot shaft (four hangers) driving one George Oldham & Son, size 2, surfacer; one 12-inch exhaust fan; and one Buffalo No. 6 forge blower.

Energy is supplied by the Commonwealth Edison Company.

Stone-cutting plant, making marble and granite tombstones, the stones being cut by hand and power tools. Group drive. Running hours per week, 60.

One squirrel-cage induction motor, of 15 horsepower, is installed. Average kilowatt-hours per month, 1,047. Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
April	1,088	August	1,168	December	1,120
May	1,117	September	1,022	January	955
June	1,132	October	1,014	February	978
July	676	November	1,301	March	994

Load-factor, 12.7; operating-time load-factor, 36.6 per cent.

MOTOR INSTALLATION.

The following is a list of the machines in this plant. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power,	Speed R. P. M.	Application.
1	15	1,120	Belted to a 40-foot six-hanger shaft driving one Curtis No. 416 8-inch by 8-inch air compressor, 50 to 60 pounds pressure, supplying air to 6 Dallet pneumatic chisels and one Dallet surfacer; one American 6-inch by 7-inch air compressor, pressure 50 to 60 pounds, used only as a reserve; and two F. R. Patch flexible arm polishers, using a 16-inch steel wheel with steel shot, a 24-inch emery wheel and an 8-inch canvas wheel for polishing.

Building-stone plant, having a monthly output of 12,000 cubic feet of sawed and planed stone.

Total connected horsepower, 225. Number of motors, 5. Average kilowatt-hours per month, 17,620.

Kilowatt-hour consumption for 5 months: March, 18,500; April, 19,100; May, 17,800; June, 18,600; July, 14,100.

Load-factor, 14.3 per cent.

The electrical energy consumption per cubic foot of stone cut and planed is 2.7 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase 60 cycle, 220 volts and 220 volts direct current.

No.	Horse-power,	Speed R. P. M.	Application.
1	150	850	Drives by chain a 20-foot shaft and 285 feet of countershafting driving one gang saw for cutting stone 17 feet long; seven gang saws for cutting stone 15 feet long (six blades each); two Bedford Foundry & Machine Company open-side two-head planers, 15-foot bed; one Bedford Foundry & Machine Company double-platen 4-head planer; two New Albany Manufacturing Company 4-head planers; one 22-inch by 12-foot engine lathe; one 24-inch drill; and one 50-kilowatt, 250-volt compound-wound direct-current generator, 700 revolutions per minute, supplying the following motors.
1	15	1,000	Shunt-wound motor geared to a W. F. Meyers 5-foot diamond saw, 640 revolutions per minute.
1	20	925	Shunt-wound motor belted to 40 feet of shafting driving one double-wire saw; one 30-inch by 10-foot stone lathe; one 6-foot by 14-foot stone lathe; and one 16-inch forge blower, 1,800 revolutions per minute.
1	15	1,000	Series-wound motor operating a Bedford Foundry & Machine Company 10-ton crane.
1	25		Series-wound motor operating a Bedford Foundry & Machine Company 15-ton crane.

An interesting plant dealing exclusively in Bedford stone, which illustrates the application of electric motors to sand and limestone cutting is that of the John Tait Stone Company, located in Chicago. This plant specializes in building stone, handling an average of 30 to 40 tons a day. For handling this stone 152 horsepower in 14 220-volt direct-current motors is installed and all energy is purchased from the Commonwealth Edison Company.

Stone in large blocks, weighing from 15 to 40 tons, is received in flat cars from the Bedford quarries on a railroad siding adjacent to the stone yard. Electrically operated derricks remove the blocks from the cars and place them on rollers under the gang saws. In the Tait plant there are two of these saws, one capable of handling a block 12 feet long and a smaller one capable of handling a stone 10 feet long. Each is driven by a shunt-wound 10-horsepower motor running at 650 revolutions per minute. After being sawed into slabs the stone is placed in the yard where it is worked for mill work. In the mill diamond saws, planers, etc., cut and shape the slabs according to specifications.

As it is necessary, of course, to protect the commutators of the motors from the dust and dampness, all are mounted on platforms above the machines. With this arrangement motor troubles have been very infrequent. The accompanying illustration shows numerous motor applications in the Tait plant. Detailed motor data are given in the accompanying sheets.

Commercial Practice
Management, Rates, New Business

Some Experiences in Operating Small Plants.

The problem of supplying electric light to the average small town is a very difficult one to solve so as to satisfy the people of the town and also the stockholders of the company. The total amount of business is limited, usually being less than three dollars per capita. The customers have small bills and use no more lighting than is necessary. The habits of the people are all very similar and there is therefore not as large a diversity-factor as is found in the large cities. The maximum load is small, probably in the neighborhood of 30 kilowatts per thousand inhabitants. In order to keep the fuel bills down to reasonable limits, and also to keep the investment as low as possible most of the small plants are content with one engine and generator of size sufficient to carry the maximum load. No spare machine is installed. As a result of this practice the machine is operated under very inefficient conditions after 11 o'clock at night and in some towns the companies go so far as to shut down at midnight in order to cut down operating expenses.

The following experiences in a small town were recounted by Robert S. Stewart, before the recent convention of the Michigan Section, N. E. L. A., and show what can be done to improve conditions.

When the new management took over the plant in question, the service rendered was till midnight only. Most of the lighting was on flat rates. No effort was made to replace lamps when they were blackened. The regulation of the plant was very poor and the pressure at the customer's lamps varied from 112 volts to 96 volts. The lighting of the stores was very poor and complaints were general. Many of the stores as well as residences preferred kerosene oil as an illuminant. The street lighting was also very poor, old open-arc lamps being used and a dynamo which had apparently seen service on the original Ark. Fortunately the dynamo armature was in two halves and half of the lamps could be kept burning while one half of the armature was undergoing perennial repairs. The moonlight schedule was in force and the moon usually won hands down in the illuminating line. The bills for electric lighting were collected whenever the company needed money. Theoretically these collections were quarterly. The rates were difficult to determine, for most of the rates of the larger customers were arranged after a discussion between the two interested parties.

The new management commenced in a systematic way to improve conditions. They were met at the start with the announcement from the inhabitant that they weren't going to stand for any meters. Much to the surprise of the inhabitants they were told that the customer would not be charged on a meter basis unless he wanted it. A schedule of rates was adopted and printed giving all customers the choice of flat rates or meter rates and specifying that a 5-percent discount would be allowed on all bills paid before the tenth of the month. In the course of a few months a few protests came in that it was too much trouble to pay bills every month and that they wished to pay by the quarter as formerly. The answer was that that was perfectly satisfactory, but when the customer found out that he would only get a discount on one-third of his bill he usually took the extra trouble to pay his bills monthly. Instead of the old carbon lamps formerly sold, Gem lamps (operating at the lowest voltage) were sold at the same price as had been formerly charged for the carbon lamps. When a customer came with a complaint that the lighting was poor, voltmeter readings were taken at his lamps to see that his pressure was suitable and if such was the case he was told the trouble was due to the fact that he had not bought any new lamps in years. The comparison of lighting from a Gem lamp with that from one of his old blackened lamps usually stopped his complaint. Tungsten lamps were installed as soon as possible, the rate charged for these being a flat rate. The high cost of the lamp and the fragile nature of the filament made it necessary for the management to guarantee the life of the lamp and they did this by agreeing to furnish one new lamp free for every lamp installed on a flat-rate contract, provided that the old lamp was returned within a year. The price of these extra lamps was included in the flat rate charge and was therefore not a hardship to either the customer or the company. The introduction of tungsten lamps on a flat-rate basis made it possible for the company to change over most of the customers who were enjoying special rates to a standard rate without offending the customers. The improvement in the lighting in the first few stores equipped with tungsten lamps made the other storekeepers see the necessity of better illumination and in the course of time the stores were so well lighted that it was no longer necessary to carry a piece of goods over to the light to see what the material in the goods was composed of.

Service till midnight was so unsatisfactory that it was decided as soon as the plant changed hands to give all-night service. The wisdom of this de-

cision was made plain in the load curve. Formerly all customers had left their lamps burning continuously and the load curve was nearly flat. As soon as all night lighting was given it was necessary to switch off lamps when they were no longer needed, for lamps burned continuously after midnight were charged extra for. The saving in power before midnight due to storekeepers turning off their light when they shut up their shops more than equalled the extra power required for the iron losses in the transformers and for the additional lighting used after midnight. The load curve began to drop down rapidly before ten o'clock and at midnight there was nothing left except the street, lighting and transformer, loss load and that of an occasional party.

The problem of improving the street lighting seemed to be very simple of solution. Tungsten lighting was introduced on one street which had never enjoyed the luxury of any light before and the company paid all of the expenses of this equipment and furnished the light without charge. The lighting was satisfactory to the residents of the street and was ultimately extended to all thoroughfares.

The result of three years' operation is the following. The rates are much lower and the customer may choose the rate which is best adapted to his requirements. All-night service is given instead of service from sunset until midnight. The regulation is much better because of the improvement in the operation of the engine and because of the heavier distribution lines and secondary lines. The number of customers has doubled. The gross revenue has increased 60 per cent. The street lighting has been very much improved at small additional expense to the town and at rates that enable the company to make a small profit on the street lighting. All night and every night service is given for the street lighting instead of service until midnight on a moonlight schedule. Competition from other illuminants has been nearly eliminated. Practically all of the stores are lighted electrically and there is one customer for every eight of population.

In spite of this increased business and revenue the capacity of the power plant remains the same and the maximum load has increased very little.

The physical valuation of the plant has not been increased much but the real valuation based on the earning power of the plant and on the satisfactory service rendered to the customers has been increased very greatly. This increase is due not to any special condition in the town or to any special engineering work, but is the result of the use of ordinary common sense. The same results can be obtained in any small town if the management will so arrange their expenses that every additional expense will bring in additional receipts in proportion, and if they will so arrange their schedule of rates that each customer can choose the rate best suited to his needs. Special care must be taken, however, to prevent the possibility of any customer obtaining service at a lower price than the cost to the company.

This story sounds like the description of an unusually badly run system, but if you will examine the small unprofitable plants you will find many or most of them suffering to about the same extent from a too shiftless or too thoughtless management.

ELECTRIC DRIVE IN A WOODWORKING MILL.

By J. E. Bullard and H. W. Watt.

The average central-station man would not consider a combination coal and lumber company operating a mill for general woodworking an especially good prospect. He would be apt to believe that with such a company the cost of fuel for operating a private plant would be very low. The wood waste would represent the greater part of the fuel, and whatever coal might be necessary could be purchased at reduced rates. In comparing costs, however, it is the market price and not the cost of the fuel that counts. In a case like

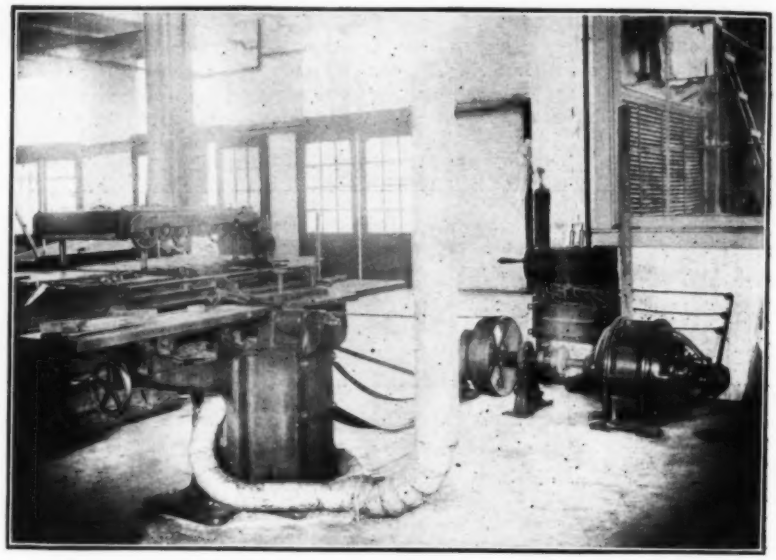


Fig. 1.—Slow-Speed Motor Driving Jointer.

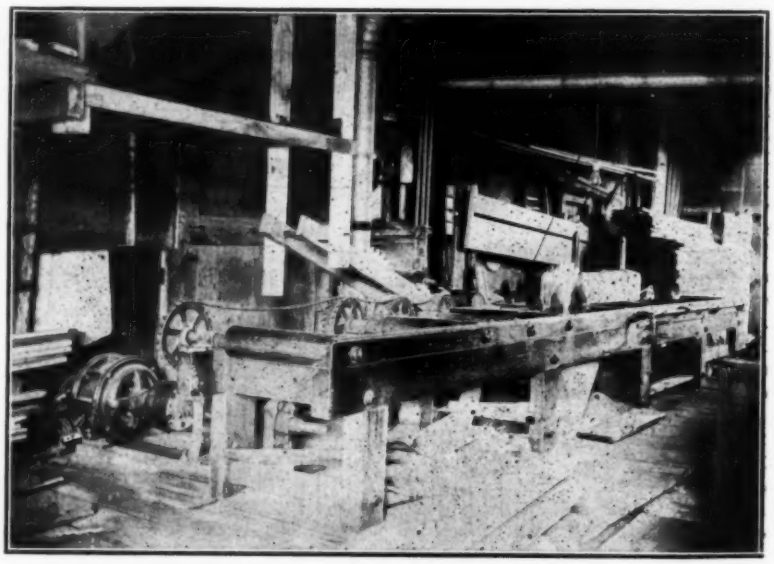


Fig. 2.—15-Horsepower Motor Driving 48-Inch Rip Saw.

this there are three ways of figuring the power costs. One way is to consider the total fuel cost for the coal used. Another way is to consider the fuel cost as the price for which the waste can be sold plus the price paid for the coal. The third way is to consider the fuel cost as the total amount for which all the fuel burned could have been sold. The private-plant salesman and the consumer are apt to estimate costs by the first method. The central-station salesman usually adopts the second. The proper way is to use the third method. This usually works out to the advantage of the central station. Such being the case the difference in power costs between the central-station service and the private plant represents the profit on the waste and coal if it were sold rather than burned.

Facts like these had great weight with the New Rochelle Coal and Lumber Company, at New Rochelle, N. Y., when it had to choose between installing a private power plant or purchasing its power from the central station. It finally decided to buy all its current from the Westchester Lighting Company. The current is purchased at 2,200 volts, two-phase, 60 cycles. It is transformed by two 100-kilowatt, Scott-connected transformers to three-phase, 220 volts, to supply the motor equipment.

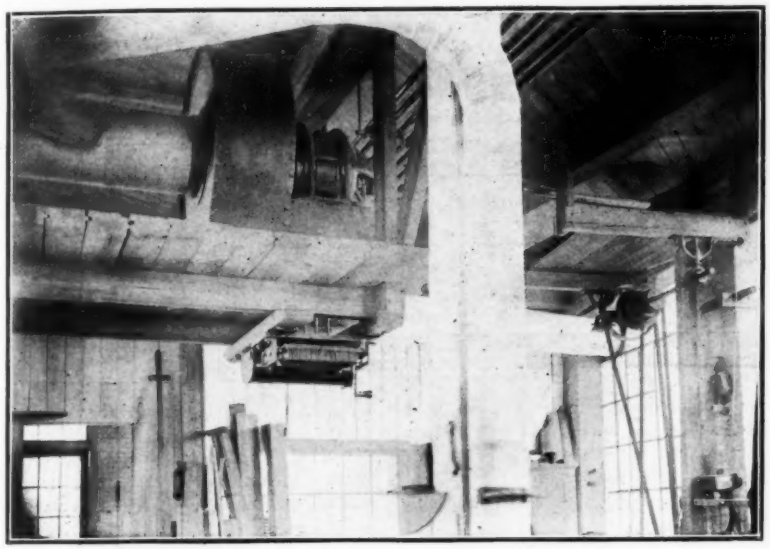


Fig. 3.—Ten-Horsepower Motor Direct-Connected to Blower.

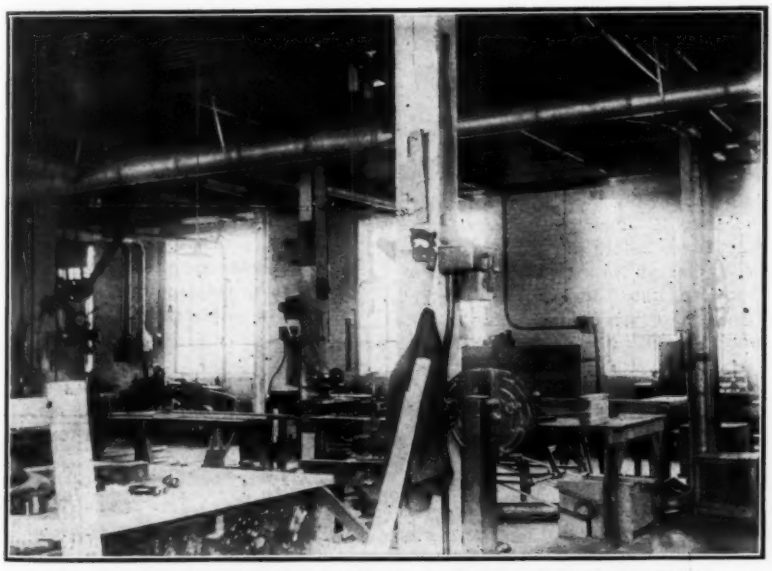


Fig. 4.—General View Showing Absence of Belting and Shafting in Plant.

Practically every machine in the mill is fitted with individual motor drive. This method proved the best and cheapest for driving the machinery. The following table gives a list of the total installation:

	Horsepower of motor
2 swing saws, each	3
3 jointers, each	3
4 rip saws, each	5
1 molder	15
2 molders, each	10
1 matcher	15
2 emery grinders, each grouped with a boring machine, each	3
1 30-inch planer	10
1 48-inch rip saw	15
1 cord-wood saw, grouped with a splitting machine	5
1 rip saw, (self-feed)	7.5
2 mortisers, each	3
1 pulley mortiser	3
1 tenoner	3
1 pocket cutter	3
1 two-spindle variety machine	5
1 band saw	3
2 stickers, each	3
2 lathes, each	3
1 drum sander	3
1 blower	20
2 blowers, each	10
1 baling machine	5
1 universal machine	7.5
1 cabinet saw	3
1 freight elevator	7.5
1 30-inch three-drum sander	15

There is a total of 39 motors aggregating 2,445 horsepower.

The accompanying illustrations give an idea of the desirability of this form of electric drive. Fig. 1 shows a slow-speed, three-horsepower motor driving a jointer. Note the convenient location of the controller which enables the operator to start or stop the machine with the least effort. The belting is also largely eliminated.

Fig. 2 shows a fifteen-horsepower motor driving a 48-inch rip saw. This also shows the almost entire absence of belting. The motor is entirely out of the way and takes up very little room. A motor-driven blower is mounted on a shelf near the saw and is operated whenever the saw is in operation.

Fig. 3 shows a ten-horsepower motor direct-connected to a blower. The entire unit is mounted on a hanging shelf where it is out of the way and takes up no valuable floor space. The controller is mounted on the under side of the shelf and is within easy reach of the operator.

Fig. 4 illustrates the entire absence of main-line shafting, counter-shafting and long belts. The only belts used are small and out of the way.

This installation has been in constant operation for about a year. With an average working week of 50 hours the consumption runs about 8,400 kilowatt-hours per month and the maximum demand averages about 50 kilowatts.

Some of the advantages of central-station service and individual-motor drive which this installation has demonstrated are as follows. The entire absence of overhead belts makes the light better. The complete elimination of line shafting reduces the fire hazard. There are no heavy inaccessible bearings which can become covered with fine sawdust and saturated with oil.

There are no such bearings to get out of order, become overheated, set fire to the sawdust and burn down the mill. The machines are placed in the most convenient locations. In several cases this location is such that it would be very expensive to transmit power to it through line shafting and belts. The machines also can easily and cheaply be relocated if for any reason it is desirable to do so. The power cost varies in proportion to the amount of work turned out. The overhead charge is very greatly reduced and with the minimum number of belts it is safer and freer from serious accidents. The speed regulation is far better than in steam-driven plants.

This plant has already aroused so much favorable comment that several other woodworking plants are planning to install individual drive and purchase electric current. The Westchester Lighting Company expects to close contracts with many of them before the close of the year and looks forward to making the year 1912 a record breaker for installing motors to be used for driving woodworking machinery.

One of the questions in an examination in English at Harvard this year read, "Give a description of the most interesting house you have ever visited." In answer to this one of the applicants, a graduate of the Newton High School, wrote a description of the House of Edison Light. Evidently the House made the right impression.

Electrical Construction

MULTIPLE-SERIES AND SERIES-MULTIPLE WIRING.

By Z. C. Adams.

Much confusion often arises in the mind of the average electrical worker when he attempts to distinguish sharply between the systems of wiring generally known as multiple-series and series-multiple.

Indeed some textbooks seem to confuse the two terms, using one for the other and leaving the reader with a somewhat vague understanding of the principles of the two systems. There is really just as much difference between the two systems as there is between simple series and multiple wiring.

The writer has hit upon a simple scheme for differentiating between the two systems, by means of which one can tell at a glance which system he is dealing with. Here it is in a nut shell. Consider the groups of lamps rather than the lamps themselves. If the groups are in multiple, the system is multiple-series. If the groups are

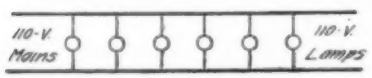


Fig. 1.—Multiple Circuit.

in series the system is called series-multiple.

Let us see how the multiple-series system is evolved from the simple multiple system that we use every day in our house wiring. Fig. 1 represents in a simple form the multiple system. In this system the lamps must be of the same voltage as the mains, since they are connected directly across them, and the current flowing in the mains is of course proportional to the number of lamps connected, or in other words the total current flowing is equal to the sum of the currents flowing through each lamp.

Now supposing that the voltage between mains is raised from 110 to 220 volts, we may still use our 110-volt lamps by combining them in series groups of two each. Our groups are now in multiple, while the lamps are in series, so that according to our rule our system is now multiple-series. (See Fig. 2.)

In this system each lamp gets only

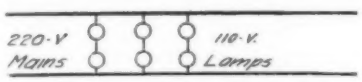


Fig. 2.—Multiple-Series Circuit.

$1/n$ the total voltage where n represents the number of lamps in series. The current flowing is now one-half what it was before, for the same number of lamps of equal candlepower. Therefore only one-fourth as much copper is required for the same percentage drop in voltage.

Let us deviate just a moment from our course to see how the three-wire system is evolved from our multiple-series system. If we run a third wire connecting all the junction points of the two lamps in each group with the neutral point of our source of supply, (i. e., the middle point of the transformer secondary winding, or the junction point of our two generators which are in series with each other) we will then have a complete three-wire system. The third or neutral wire of the system will carry no current just so long as the loads on each side of the neutral are equal. Should, however, a portion of the lamps on one side burn out, or the system for any reason become unbalanced, then the neutral wire will carry a current equal to the difference between the currents flowing on either side. Since the neutral wire is usually made equal in size to the outer wires, it is evident that the three-wire system requires only three-eighths as much copper for the same drop and load, as the two-wire system.

Referring again to Fig. 2, it is evident that if we remove all the groups but one, we will have a simple series system. Therefore, the only difference between the series system and the multiple-series system is that the latter consists of several groups instead of one group. Or in other words, the first consists of a series of lamps, the second consists of a multiple of series of lamps.

The National Electrical Code does not approve of multiple-series or series-multiple lighting systems, but does allow simple series lighting under certain conditions, and also permits small motors to be connected in series-multiple or multiple-series, but only with

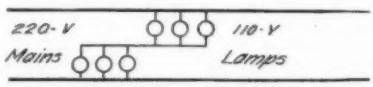


Fig. 3.—Lamps Connected in Series-Multiple.

the special approval of the local inspection bureau.

We see from our study of the subject thus far, that wiring that frequently passes for series wiring, is strictly speaking multiple-series, since there are nearly always more than one group of lamps used. The writer therefore believes that the Code should be a little more explicit in this particular ruling.

The multiple-series system is used to a considerable extent in car lighting, car and suburban-station lighting, and

in other locations connected with street-railway work. We also find the system used to a small extent for sign wiring and decorative lighting, especially since the advent of the low-voltage tungsten lamp.

We now come to the series-multiple system, which is still more closely related to the three-wire system, since we actually have a third wire running throughout the system, which is common to every two groups of lamps, but which does not connect with the source of supply.

This common wire will carry no current beyond those points at which the first lamp of the first group and the last lamp of the second group tap off, and of course need not extend beyond those points. The current flowing in the common wire will divide proportionally among the lamps connected in multiple to it. The total current will likewise be proportional to the number of lamps in multiple on one side of the system, and each lamp will receive $1/n$ times the line voltage, where n stands for the number of groups in series across the mains. In Fig. 3, n is of course equal to 2, but might be any number, according to the ratio of the lamp voltage to the line voltage.

A serious disadvantage of this system is the unbalancing feature. When part of the lamps in one group burn out, the remaining lamps in that group are forced to carry an abnormally large current.

The system has however found some adaption for sign work, and forms a convenient method of banking lamps for testing purposes.

Suggestions Supplementing the Code.

The Washington Surveying & Rating Bureau, of Seattle, Wash., has adopted the practice of inserting under the front cover of each copy of the 1911 edition of the National Electrical Code which it gives out, a small pamphlet containing suggestions along the line of good electrical construction and the proper interpretation of the Code. There is also an index of the changes in the Code incorporated in the 1911 edition thereof.

Some of the more interesting matter in this pamphlet is given below.

General Suggestions.

In laying out a system of electrical wiring for a building the chief considerations are—safety, satisfactory operation, convenience, neatness, and economy. That system which combines all of these is the ideal. The characteristics of the three principal types of installations are as follows.

Open cleat—this method of wiring, while low in first cost, has high maintenance charges and lends itself admirably to extensions by incompetent persons. Wires become interfered with; pulled down from their supports and broken, and in contact with wires of other systems such as telephones and bell circuits; also in contact with pipes and surfaces. All of which tends to increase the fire hazard and to interrupt service.

The concealed knob-and-tube system, while not open to as many criticisms as the open cleat has still some bad features. There is the constant deterioration of insulation on the conductors and disarrangement of wiring by lathers, and moisture troubles which cannot be detected until serious trouble results.

Conduit wiring when properly installed closely approaches the ideal. The conduit will last as long as the building. Old wiring may be withdrawn when it becomes defective or too small to properly carry an increased load and new wire drawn in its place. Conduit installations usually are more free from extensions made by incompetent persons. While the cost of conduit installations is greater than either of the two systems above mentioned, this is more than compensated for by its advantages. Great stress should be laid on these facts to make the use of conduit more general.

Flexible cord—perhaps no piece of apparatus suffers greater abuse than flexible cord for pendant purposes. Common lamp cord should be used only for lamps which hang freely in the air and which are not likely to be moved sufficiently to come in contact with surrounding objects.

The use of this cord is common in mercantile risks, department stores and dwellings and many fires have been directly traced to its misuse. For all portable work flexible wires and cables especially designed to withstand this severe service should be used and the lamp should always be protected by a substantial lamp guard. Incandescent lamps are a source of danger if not properly protected, as there is generated in them sufficient heat to carbonize certain materials as wood, paper and cloth, which would burst into flame at any minute when in this condition. The lamp guard is further a paying investment, preventing as it does, the breakage of lamps.

All cut-outs must be placed in approved cabinets whether the inclosed cartridge, plug, or open link type of fuses are used. Field experience has fully demonstrated the fact that the open link fuse is often substituted for the cartridge and plug fuse, making poor contact and resulting in the heating of the terminals, which is very liable to cause a fire. The blowing of an open link fuse is always attended with danger. The fire records are full of instances of fires which would probably have not occurred had the cut-outs been properly placed in cabinets.

It is strongly recommended that all cabinets be constructed of steel. The wood cabinet is liable to get out of shape so that doors will not close. A cabinet is of no value unless the door closes snugly to the rabbet and is kept closed at all times.

In laying out an installation, the fuses and switches should be grouped at centers of distribution as far as possible to facilitate the renewal of fuses and other repairs.

Service switch should be located as close as possible to the point where wires enter building, not to exceed 15 feet, and within 7 feet of the floor.

At three-way and gang switches taps must be made and secured outside of boxes.

Where short pieces of conduit are used same must be equipped at each end with condulet or outlet box.

Where conduit is used for service outlets, conduit must extend beyond building at least 12 inches and must clear all awnings.

Wires must be knobbed so that strain will not come on tap or end of tubes.

Wires must be knobbed at top and bottom of partition, that is, just above mud tubes and below the plates.

Broken tubes or knobs must not be used for mud tubes.

In attics which are reached by a stairway, wires must be run through floor joist and in no case knobbed on under side of roof rafters.

In attics which are reached only by scuttle hole, wires must be kept at least 5 feet from same and must not be knobbed to top of floor joists.

In open attics where it is necessary to jump from ceiling joist to roof rafter, wire must be run as close as possible to the eaves, or be protected by suitable boxing.

Service outlets must be kept at least 6 inches apart.

No wire smaller than No. 12 may be used for service outlets.

On conduit work, cabinets, junctions and pull boxes must be made of painted galvanized or enameled iron, the minimum thickness of same to be No. 14. With wooden door and trim such parts must be lined with sheet metal, the minimum thickness of which shall be No. 16 steel.

Conduit must be installed so that it will not be necessary to leave fish wire in same in order to pull in conductors.

Where outlet boxes are used for meter loops, approved bushings must be used to bush holes.

Each meter or flat rate circuit must in all cases be controlled by separate fuses.

Where meters are not banked either a switch or fuse block disconnecting all wires of meter loop must be installed.

Where cord drops are to be installed on combination outlets, where gas fixtures are in place, gas fixtures must be taken down or an insulating joint installed in fixture.

Canopies must not be secured to ceiling until after inspection.

Great care should be exercised in the choice of circuits and the number of outlets on each that for present or future use the load is kept within the 660-watt limit. In keeping with this it is strongly urged that for common or residential lighting no more than 8 outlets be allowed per circuit and for business purposes less than that number.

Bell-Ringing Transformers.

(a) Must be so mounted that the case shall be at a distance of at least one foot from combustible material or separated therefrom by non-combustible, non-absorptive insulating material, such as slate, marble or soapstone. This will require the use of a slab or panel somewhat larger than the transformer.

(b) The primary wiring must be installed in accordance with rules for class "C" wiring in the National Electrical Code. Each transformer must be protected by a fuse not exceeding 2 amperes in capacity. No lighting will be permitted on the primary wiring of the circuit.

(c) Must be protected from mechanical injury when so located as to be liable to such injury.

In cities having inspection departments where local requirements are more rigid than the Code these local requirements must be rigidly enforced in all cases.

In the event that any doubt exists relative to the interpretation of the Code rules same should be referred to the City Inspection Department or to the Electrical Department of the Washington Surveying and Rating Bureau.

It is urged that specifications covering electrical installations have a clause inserted requiring a certificate of approval from this latter office. No fee is charged for inspection other than the necessary traveling expenses of an inspector from and to Seattle. When several inspections are made at any one time these expenses will be divided among the various parties calling for the inspection.

Drying Out Motor Windings.

An exchange tells of a plant in which some 5,000-volt alternating-current motors became so damp during a period of idleness that it was unsafe to put them into service again without first drying out the windings. They were dried by being connected to the low-tension side of a transformer which stepped the pressure down from 5,000 to 260 volts. The atmosphere of the room being very damp, the motors were thereafter connected to this low-pressure circuit whenever they were to be put out of commission for awhile, and it was found that this process, though not a very economical one, prevented condensation on the windings.

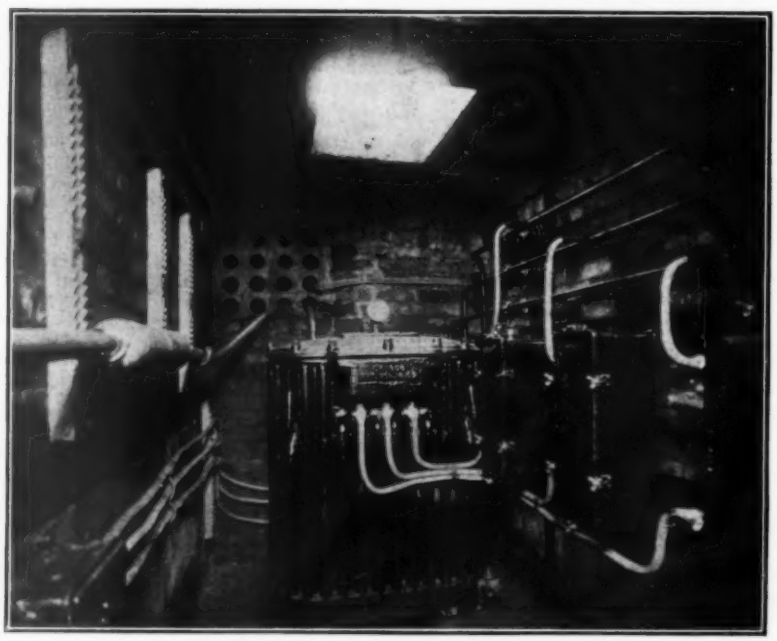


Fig. 1.—Showing High-Tension Cables and Transformer.

The voltage was not sufficient to cause the machines to run, but was sufficient to keep the windings warm.

SOME INTERESTING UNDERGROUND ELECTRICAL WORK.

A Description of a High-Tension Installation.

In the case of overhead electrical circuits the location of faults is often very easy and the making of repairs relatively simple. Hence, although it is always highly desirable that overhead work be skilfully and carefully installed, lack of thoroughness in such work does not, as a rule, lead to such annoying consequences as may be expected when underground installations are not properly made. On certain classes of underground construction, moreover, the conditions of service are peculiarly exacting. For example, in the case of some underground installations of transformers, the transformer vaults are liable to be more or less damp always, and during heavy rains they may be flooded to such an extent as to submerge completely the electrical work within them. The construction shown in the accompanying photographs, besides being a splendid example of proper design and good workmanship, is especially interesting as showing how work must be done to withstand the trying conditions just referred to. Furthermore, the installations illustrated here being parts of the equipment of the signaling system of a great railway, it was necessary to install all apparatus and circuits with a special view to insuring the greatest possible freedom from breakdowns, and, at the same time, in such a way as to make the equipment as convenient as possible for inspection and repairs in case troubles should occur.

Fig. 2.—Method of Running Leads to Primary and Secondary Fuses.

Figs. 1, 2, 3 and 4 are photographs of subway transformer installations of the Chicago & Northwestern Railroad. The plants seen in the figures, and a number of others similar to these, were installed for this road not long ago by A. S. Schulman, one of the large electrical contractors of Chicago.

The transformer vaults, a large part of the interior of one of which is shown in Fig. 1, are located near the signal towers and signal bridges which they

serve, these extending for some distance from the Terminal Station in Chicago out along the two divisions of the road. Alternating-current power is brought into each vault at a pressure of 6,600 volts. Here it is stepped down to 220/110 volts, at which pressure it is transmitted to the nearby tower or bridge. The transmission both to or from the transformer vault is effected by means of lead-covered cables drawn into Orangeburg fiber conduit laid underground. The transformers shown in the photographs all happen to be three-phase units, but single-phase transformers are employed for supplying service to the signal bridges. The three-phase transformers furnish current to signal towers, the load here being heavier than that at the bridges.

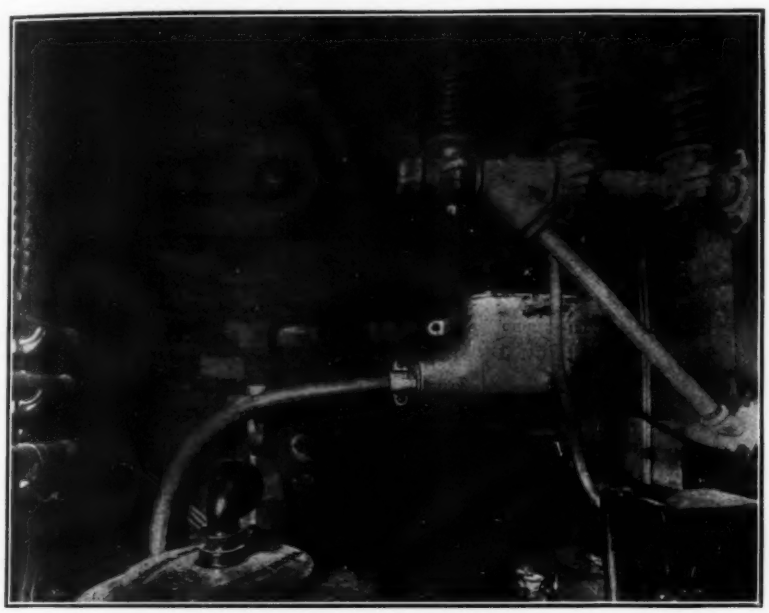


Fig. 3.—Cable Bell and Part of Bus-Bar Rack.

The transformers in these plants, which were manufactured by the General Electric Company, are of the standard subway type. The iron tanks containing the coils, and the oil in which these submerged, are air and water tight. Each tank is equipped with a drain plug and an oil gauge. There is also an opening in the top of the case which under normal conditions is kept closed by means of a sort of diaphragm. This diaphragm is arranged to open automatically and allow the escape of gases and oil in case the latter should become excessively hot as the result of an overload on the windings.

The point of entrance of two high-tension cables is shown in Fig. 1. One of these cables passes through to another vault, and the other supplies current to the primary of the transformer seen in the picture. The high-tension primary cable passes into a cable bell in the manner indicated in Fig. 3. One of these cable bells, all of which were supplied for this job by the Electrical Engineers Equipment Company, of Chicago, is shown clearly just under the iron-pipe frame work in the right-hand side of Fig. 3. This bell is so arranged that no wiping of joints is necessary to secure a water-tight joint where the lead-covered conductors enter it. From Fig. 4 it may be seen how the conductors are brought out of the cable bell and carried to the bus-bars from which the primary side of the transformer is supplied with current.

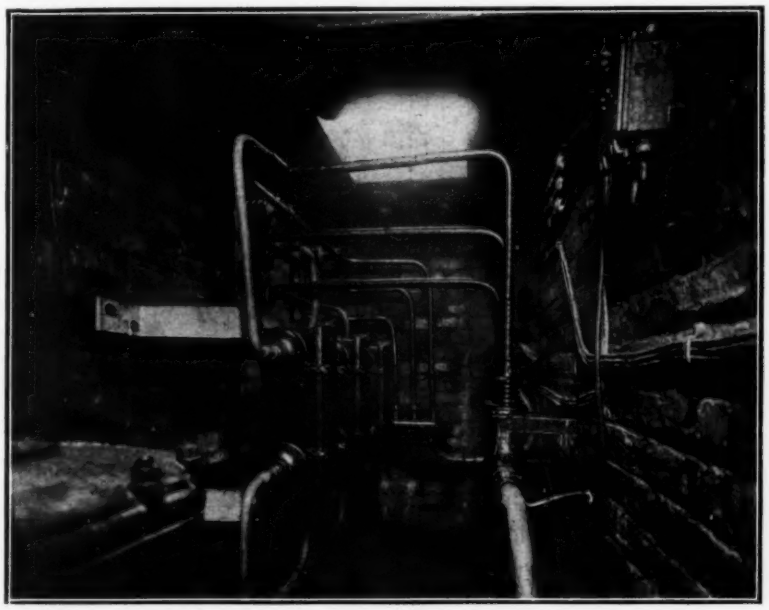


Fig. 4.—High Tension Circuit Passing Through Vault.

In Figs. 1, 2 and 4 the bus-bars are supported by means of high-tension insulating supports bolted to an iron framework secured to the wall by means of expansion bolts. All iron work in these installations is of galvanized material and all bolts, screws and the like are of brass. A different type of bus-bar support is shown in Fig. 3. Here the supporting rack is made of galvanized iron pipe.

The busses are 10,000-volt Okonite solid 4/0 conductors. The Electrical Engineers Equipment Company's bus-bar supports are used, and these have been subjected to a test of 28,000 volts while wet, it is stated.

The boxes seen below the bus-bars in Fig. 1 contain the primary fuses. These are General Electric water-tight, cast-iron fuse boxes, there being a separate box and fuse for each lead of the primary circuit. The primary lead is brought to the fuse cabinet, and also run from the cabinet to the transformer, as lead-covered cable. In Fig. 4 the method of passing into and from the fuse cabinet is shown. The lead covering is slipped into a sleeve and a wiped joint made, this insuring a water-tight connection. A somewhat similar process is employed in connecting to the transformer.

The low-tension sides of the transformers are also fused. "Noark" fuses, made by the H. W. Johns-Manville Company, are employed in the secondaries.

Fig. 4 is especially interesting as showing the method of tapping off for a transformer connection on a high-tension circuit passing through the vault where the transformer is located, to another vault more remote. The figure shows rather well the neat, thor-

ough construction characteristic of the entire job.

One of the ground wires to the primary cable is shown on the wall at the back of Fig. 3. Throughout the system, all cables, transformers, primary fuse boxes, and bus-bar racks are connected together and grounded with No. 4 copper wire, at each vault, the arrangement being such that the ground connections are not over 600 feet apart. At these connections, the ground wire is carried down through conduit to depth of 30 feet below the surface of the ground, to a Federal ground plate. It was considered advisable to carry the ground wire to this depth because of the nature of the filling-in around the vaults, this being of sand and gravel, a material which tends to dry out rather quickly.

Wiring for Moving-Picture Theaters.

It seems that there is a disposition on the part of some of the owners of

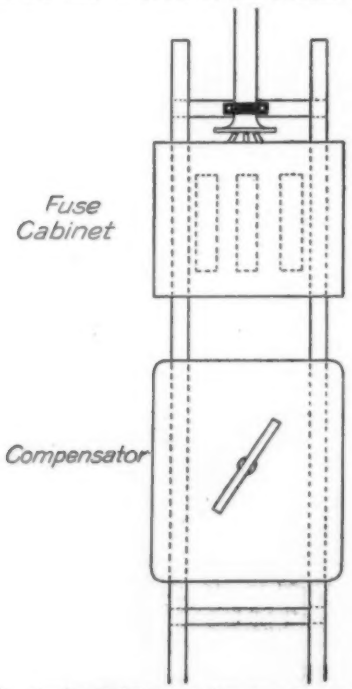


Fig. 1.—Front View of Compensator and Fuse Cabinet.

moving-picture theaters in England to adopt the use of small electric generators driven by means of oil, gas or gasoline engines as a source of power. *The Electrical Times* thinks that this tendency, which is unfortunate both for the owners of theaters and for the central stations, may be due in a measure to the fact that ordinary lighting rates are sometimes charged for power consumed in the operation of the lantern arc. It is stated that storage batteries have been employed to make it possible for the theater to keep off of the central-station lines during hours of peak load.

The practice of throwing the lantern arc directly on the circuit, with only a resistance in series with it to reduce the voltage, is deplored in the paper referred to, and the use of the motor-generator set is suggested. The arrangement proposed is such that the arc may be operated either from this set or thrown on the line directly, at will.

Nothing but electric light or limelight is allowed within the lantern, and even then the film is liable to catch fire if it stops for a second or two, according to this writer.

Nothing but electric light or limelight is allowed within the lantern; even at that the film is prone to fire if it stops for a second or two. So long as it travels rapidly past the focussed beam it is safe. Within the lantern-room all insulation of cables must be wrapped with fireproof material. When the lamp is working there must be no more than 110 volts across the double-pole switch.

There must in all cases be a separate control switch for the auditorium lighting placed in the auditorium. The lantern service must be on a separate circuit from the source of supply. No wooden switchboards are suitable for this work, iron frames should be employed, with as little slack cable behind them as possible. The Home Office, in fact, calls for a minimum of slack cable and for simplicity of connections easily followed out.

It is in the working of a lantern film that the electric arc comes almost into contact with an explosive, says *The Electrical Times*. This journal thinks that behind the scenes, in the course of a provincial weekly change of program and scenic arrangements, Providence is tempted very sorely sometimes. No true friend of electric lighting would claim that it cannot give rise to fires in such abnormal circumstances; it is only possible to establish that electric lighting is immeasurably safer than any other illuminant. Hence it is used in powder magazines and gas-works.

Powers of New York State Board of Fire Underwriters.

Attorney General Carmody of New York, in an opinion given last week, holds that neither the New York state board of fire underwriters nor any other unofficial body has legal jurisdiction to name conditions, frame specifications or supervise the installation of electrical appliances in public or private buildings. Such powers, the attorney general holds, are to be exercised only by the state fire marshal.—*Insurance World.*

MOUNTING COMPENSATORS AND CUTOUTS.

By H. G. Wilson.

The location of the cutouts and compensators for induction motors is generally decided upon by relative convenience of operation and good mechanical support, the latter being on account of the weight involved, especially so in the larger sizes. In shops of the average size the walls are generally used for supporting cutouts and compensators, but with motors placed in the middle of shops of the larger kind, other means of support must be devised. The figures explain one of such, in which the roof supports, consisting of 12-inch cast-iron pillars, were used for this purpose.

To the two ends of a piece of five-sixteenth by two-inch strap iron, long enough to partially encircle the posts, were welded to threaded pieces of half-

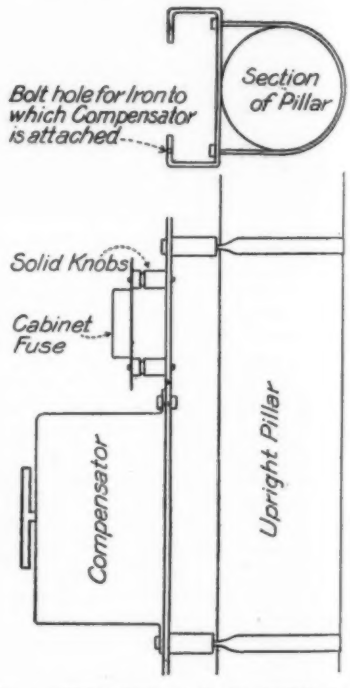


Fig. 2.—Side View of Same Installation.

inch rod iron. Two of these pieces, one for the top and one for the bottom fastening, clamp the framework to the posts. Figure 2 shows a piece of half-inch by two-inch iron used for the fastening of the clamps, as well as for the vertical strips of one-fourth by two-inch strap iron, to which the cartridge fuse slate base and compensator is also bolted.

The extra space provided by reason of the "U" shape of the ends of Fig. 2 gives plenty of room for the connecting cables between the studs back of

the fuse base and the compensator.

The slate base is mounted as shown and has No. 5.5 solid knobs placed between it and the framework. The conduit containing the feed wires is ended in an outlet fitting, having a three-wire opening, and is fastened by means of a strap of thin iron to the crosspiece shown in the sketch. After the wires pass through the starting mechanism they are run to the motor in conduit, this being changed to meet the different requirements of the motor locations.

Among the Contractors.

James H. Linker has recently started in the electrical contracting business at 6 West Main Street, Bozeman, Mont.

L. H. Lamont, 160 North Fifth Avenue, Chicago, has been awarded the contract for the electrical work in the Irving School building, in that city. The contract includes the wiring for 500 incandescent lamps and one motor.

The Alloway Electric Company, 30 North LaSalle Street, Chicago, is installing the electric wiring for 440 incandescent lamps in a new building erected by George Bockus, in Chicago.

The firm of Henry Newgard & Company, 945 Washington Boulevard, Chicago, has secured the contract to install the wiring for 650 incandescent lamps and 29 motors in the wall paper mill of Sears, Roebuck & Company, in that city.

Herbert Hymer, formerly with the James Clark, Jr., Electric Company, of Louisville, Ky., has started in the electrical contracting business in that city. His office is in the Realty Building.

A. D. Hotson, constructing electrical engineer, Vancouver, B. C., has recently moved his place of business from 625 Pender Street to 1059 Hamilton Street, where enlarged shop facilities are available.

E. D. Fuchs & Company, 64 West Randolph Street, Chicago, has obtained the contract for wiring the Hyde Park Hotel, Chicago, for 800 incandescent lamps.

The firm of Kohler Brothers, 343 South Dearborn Street, Chicago, has been awarded the contract for installing the wiring for 800 incandescent lamps and 7 motors for S. Phillipson, Chicago.

The Miles City Electric Company, of Miles City, Mont., is installing the wiring in the new Smith Block in that city. This is a three-story block, built of concrete, and the wiring will be entirely in concrete.

Through the co-operation of the Commercial Club with Hughes and Deiters, owners of the electric light plant in Dickinson, N. D., an ornamental street lighting system will be installed in that city. The initial installation will consist of 84 five-light cluster, ornamental posts. An arrangement has been arrived at whereby the merchants on those streets on which the posts will be placed will pay for the installation while the city will pay for the current.

The Dickinson Electric Wiring & Fixture Company will install the system, upon which work will be started shortly.

BOOK REVIEW.

"The Cornice Work Manual." By Sidney P. Johnston. Chicago: The American Artisan Press. Cloth, 234 pages (5½ x 8¼ inches), 184 illustrations. Supplied by the Electrical Review Publishing Company for $3.50.

Although written for sheet-metal workers, this volume should interest electrical men for two reasons, one being because of the forty cuts of knots and rope fastenings in the chapter on "The Management of Ropes and Hoisting Tackle." Few contractors or wiremen know how to use ropes with assured safety when hoisting materials.

The other reason lies in the contrast between the apparent lack of progress in the methods of sheet-metal workers (as reflected by this volume) and the methods of the modern electrical contractor. The fact that the publisher of one of the leading weeklies in the metal-working line should be justified in issuing such a book from plates made twelve years ago, tells its own story and this is confirmed by the meager chapter on the important theme of "Estimating." This does not even hint at the systematic cost records used by successful contractors in other lines, nor does it give any detailed example to show how the costs may carefully be figured even in a crude way. Instead, it generalizes and lays down this remarkable rule for ascertaining the cost of the labor on a given piece of a conventional type: Take the price at which others sell this piece and deduct the cost to you of the material in it; the difference will be the desired cost of the labor plus your profit. How many electrical contractors would survive if they figured their costs by the same method?

However, the 170 cuts devoted to cornice making are clearly drawn and well explained, so that aside from cost-figuring the book should prove a valuable one for sheet-metal workers.

ALBERT SCHEIBLE.

LETTER TO THE EDITOR.

Explanation of a Static Prank.

To the Editor:

On page 210 of your issue of August 3, is an article by Philip Edelman, entitled "A Static Prank and a Conclusion." This is a description of a very interesting incident, or probably we may say coincidence. We disagree entirely, however, with the explanation given by the author of break in the wire.

The author considers that the burning in two of the wire was caused by "the resistance of a right-angle bend to a high frequency discharge." It should be borne in mind that the impedance of an ordinary circuit to high-frequency discharge is almost entirely made up of reactance and not resistance. The effect of a bend even upon this reactance is frequently very greatly exaggerated. Unless an actual loop exists, the principal effect of turns and bends is due to the increased length of wire. (For the benefit of critics, this is a mild statement.) The *resistance* per unit length is no greater at the bend than elsewhere for any frequency which might have existed. The melting of the conductor at this point cannot be explained in any degree in this manner.

The writer will venture a possible explanation. It seems possible that the conductor may have been very much weakened mechanically at the bend, perhaps very nearly broken in two. Even in this condition its continuous carrying capacity would probably exceed that of the fuse wire which protected it. Now when the lightning discharge took place, the high potential caused a discharge across the lamp socket. The heating of the wires of the circuit by the lightning current was probably very small, but the dynamic current followed the static spark, producing a short-circuit. With the high current of the short-circuit, heat was generated at the portion of small cross-section at the bend too rapidly to be carried away by the adjacent copper and the wire was burned in two at this point before the fuses could act. Of course, the small clearance between the ends would not suffice to clear the circuit which was finally opened by the blowing of the fuses. The same effect might have taken place had the short-circuit been induced by any other cause. The explanation offered may not be the true one but we are certain that the explanation offered by the author is mistaken. However, his conclusions regarding the desirability of strict adherence to the Code requirements and to the inadvisability of too sharp bends are not affected.

R. W. ATKINSON,

Pittsburgh, Pa., August 10, 1912.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Pulling Wires Out of Conduit.

While re-wiring a building recently I found it difficult to pull some of the old conductors out of the conduit, as they seemed to have stuck to it. After pulling for some time without success, I pushed a fish-wire into the conduit, and was able to fish alongside the conductors to the next outlet. Then by seesawing the fish wire back and forth several times I loosened up the conductors and they came out easily.

W. J. Ayton.

Plan for Putting Standard in Circuit.

Finding it necessary to calibrate our switchboard instruments I made up an attachment as shown below.

Our switchboard is equipped with cartridge fuses, having knife-blade con-

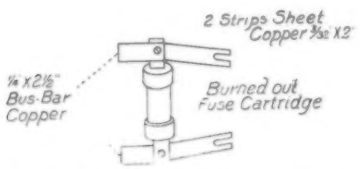


Fig. 1.—Fuse and Connections to Shunt.

tacts. I drilled half-inch holes through the contacts and bolted a piece of busbar copper on either end. I also bolted two strips of three-thirty-seconds-inch copper on either end with the same bolts that hold the busbar copper. The busbar copper is one-fourth inch thick and fits the same contacts as the fuses. The strip copper has slots cut in it to receive the shunt of the standard instrument. By loosening the bolts which hold the strips they may be moved closer together to fit the shunt. In running the test the fuse is removed from the circuit, and one which has been blown is substituted for it.

George M. Martin.

Making Conduit Couplings.

When it is necessary to put in a "runner" or "running thread" in conduit the following may be serviceable.

Cut a thread on one pipe long enough to allow the coupling to screw clear on and expose the thread. Saw off about one-quarter inch of the coupling, screw it clear back, and then put on the rest of the coupling. The larger part of the coupling may now be run on to the pipe to be coupled up and the quarter-inch part used as a locknut without turning either pipe. Both pipes are butted and the joint is as solid as in a straight run and looks just the same.

A. J. Drummond.

An Interesting Method of Installing Cutout Cabinet.

The accompanying sketch shows a convenient and practical way of arranging the circuits of a cutout panel when there is not room to bring the branch circuits out at the sides of the cutout panel box. All circuits are carried through conduit. *A* is a standard cabinet containing switches and cutouts for several lighting or small-motor circuits. *B* is a steel junction box installed near the ceiling. *C* represents the main line passing through the junction box to the cutout panel. All the branch circuits are carried from

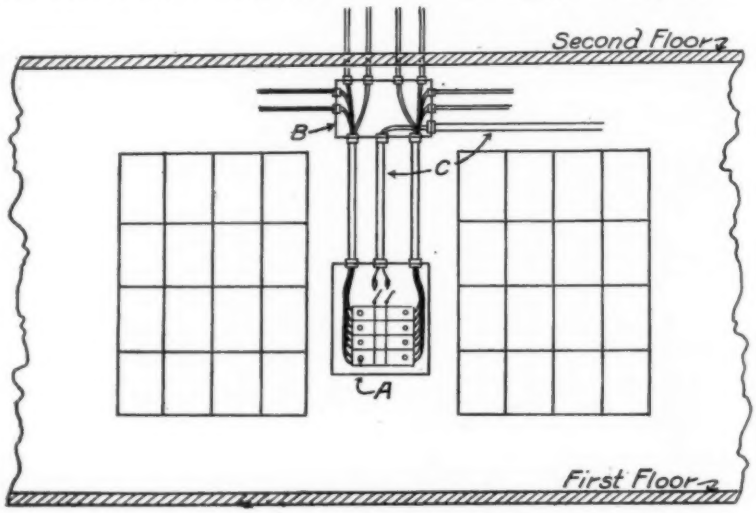


Fig. 2.—Arrangement of Cabinet.

the cutout panel through two conduits to the junction box. From the junction box each circuit is carried through its own conduit to the lamps or motor for which it is to provide current.

G. J. Leach.

Putting Wire in Fixture Arms.

In some cases where fixture arms are full of bends and right-angle turns, it is almost impossible to get anything through them. By taking several lengths of chain from pull-chain sockets and soldering them together to the length you require, you can drop this chain around through the bends and turns without trouble, and pull through a small iron wire, by means of which the fixture wires can be pulled in.

F. J. Holzhauer.

Electric Alarm for Water Gauge.

I have just been called upon to make an electric device that will sound an alarm when there is low water pressure. I accomplished this by connecting a six-inch electric bell in a circuit with a specially prepared water gauge. I took a common water gauge and insulated the inside mechanism, which includes the hand, from every other part of the gauge. To a fixed part of this I soldered a short piece of fixture wire; and the other end I connected to a well insulated binding-post, which was made fast to the outer rim of the gauge case. I also insulated the dial from all other parts of the gauge, and soldered a piece of fixture wire to the under surface of this, and connected the other end of the wire to another building post on the outer casing. We wanted the alarm of sound when the water pressure reached fifteen pounds; so I treated my electric gauge for fifteen pounds water pressure, then fastened a small brass post on the dial, at that point, just below the hand.

As can readily be seen, the hand striking the post closes the circuit. Where the hand strikes the post I soldered to it, a very small thin piece of sheet copper giving better contact surface. I connected my electric gauge to the water pipe where the pressure is just the same as it is on the standard water gauge which is located in the engine room, and then connected my electric gauge in series on a common alarm-bell circuit, locating my bell centrally, so that it is distinctly heard from every part of the engine room. For stopping the bell from ringing I cut in a five-ampere single-pole snap swith on one side of the line.

It is now impossible for the water pressure to go down to fifteen pounds without sounding the alarm.

W. A. Hines.

Legal Notes

RECENT LEGAL DECISIONS RELATING TO PUBLIC-UTILITY COMPANIES.[1]

By James V. Oxtoby.

This article discusses the status of outstanding contracts when a public-utility company comes under the rate-regulating power of a state commission, the right of such a commission to inspect the books and regulate the accounting of a company engaged in interstate business, and the position of a company which must have the issuance of securities approved in two or more states.

From the many recent decisions on the subject of the rights and duties of public-utility companies, I have selected three which are of particular interest to companies operating in Michigan. These are

(*a*) the decision of the Michigan Supreme Court in the case of the Citizens Telephone Company of Holland;

(*b*) the decision of the United States Supreme Court in the Goodrich-White-Star-Line cases;

(*c*) the decision of the Michigan Supreme Court, and of the Michigan Railroad Commission, in the Peninsular-Power-Company case.

Status of Outstanding Contracts Made by a Public-Utility Company.

Two questions suggest themselves in considering the question of the status of outstanding contracts when the rates of charge fixed by such contracts are being investigated: (1) Do outstanding contracts which provide for certain rates unjustly discriminate against a later customer, who is charged a higher rate, under a new schedule put in force by the company? (2) Are such outstanding contracts binding, or may they be set aside by a commission when it undertakes to regulate rates?

The first question was considered in 1910 by the Supreme Court of Michigan in the case of Bradford vs. Citizens Telephone Company, 161 Mich., 385. Here the court apparently held that a telephone company, which renders identical service to all subscribers, makes an unlawful discrimination in violation of the provision of the statute, if it charges new subscribers a higher rate than it charges old subscribers. When the case is carefully examined, however, it does not fully cover the question we are discussing.

In this case the complainant claimed that the defendant telephone company was discriminating against him in the matter of its charges for telephone service. The telephone company's rates prior to January 1, 1908, had been $15 for residences, and $24 for business places. On January 1, 1908, the rates were raised as to all new subscribers to $18 for residences and $30 for business places. The company undertook to divide its subscribers into two classes, to wit, old ones and new ones. All subscribers prior to January 1, 1908, were given the old rate, and all subscribers after January 1, 1908, were charged the new rate. The company sought to justify this difference in the rate on the ground that its business could not live at the old rates charged, and that the increasing expense of operating the telephone exchange was due to the increase in the number of subscribers, and therefore, the new subscribers should pay the increased rates.

The company had made term contracts (for five and ten years) up to January 1, 1908, at the $15 and $24 rate, and it further held itself out as ready to make such contracts with old subscribers who were willing to make such contracts after January 1, 1908. Further, the company knew, when it made such contracts, that its rates were too low.

Both the Circuit Court and the Supreme Court held that the complainant (who was a new subscriber) was entitled to service at the rate charged old subscribers, and that the rate which the company was undertaking to charge new subscribers was discriminatory. If the company had merely undertaken after January 1, 1908, to perform its existing contracts, and before raising the rates had not sought to increase the number of such contracts, and had not held itself out as ready and willing to continue to give service to its old subscribers at the old rates, (even under new term contracts) I think the Court would have reached a different conclusion. The decision on its face suggests that the existence of term contracts constitutes discrimination against new subscribers, who are charged higher rates. But when read in connection with the record, the decision does not go so far. The decision does not make this distinction clear, but the Court was dealing with a state of facts which perhaps did not suggest this distinction.

In my opinion the existence of contracts giving rates to customers, which rates, if made general and perpetual, would result in making all rates unreasonably low, should not be taken as the test of a reasonable rate, nor considered as an undue discrimination, if it appears that the company is in good faith seeking to avoid discrimination, and is merely fulfilling its existing contracts.

Probably every electric light and power company has some special rates in force. These rates, if offered to all customers under the same circumstances, are not subject to criticism on the ground of unjust discrimination. Very frequently such rates are experimental. They are being tried out, so that their effect in building up a new class of paying business may be learned. It may develop that they are too low, in which case they will not be continued after the contracts, under which they have been given, have expired. They may, on the other hand, be clearly discriminatory. If they are, they should be cancelled, or other customers of the same class should be given the same rate. It should be remembered, however, that a rate lower than a regular rate given to a customer in one line of business does not actually damage one in another line of business. For example, a sausage maker is not damaged because a bookbinder or an automobile manufacturer is given a lower rate for electric power than he is. I think they should be given the same rate, if they are using the same quantity of power, under the same conditions and for the same hours, but the fact remains that, unless the company is trying to raise its rate to the one to make up for its low rate to the other, the former is not actually damaged.

Any rate, special or general, which is less than cost, is against public policy, for the reason that its tendency is to cripple the ability of the company to

[1] Paper read before Michigan section, National Electric Light Association, June 22, 1912.

properly serve the community. In fact, if persisted in, it will inevitably so result. A rate which does not furnish some profit may throw a burden upon other customers. It will actually do so, if the company is trying to earn its full reasonable profit on its entire investment out of such others. If on the contrary, the company is itself standing the loss of profit on the business which it is doing at a loss, and is earning on its other business only the reasonable profit properly chargeable to it, and which it ought to pay anyway, then the others have no interest in the matter, and public policy is not offended, provided discrimination does not exist.

If it appears in the course of an investigation by a commission that some special contracts are in force, which give rates lower than the rate which it finds is the proper maximum rate for customers of the class to which those holding such contracts belong, I believe that its order should provide that those contracts should stand until they expire by their terms, when they should not be renewed. It may be that in the meantime, if there is some customer in the same line of business and who belongs to the same class (size, hours of use, and other conditions equal), and who would be personally damaged if not given the same rate, he should be given such rate for the period during which the special contract is running, when both can then be placed on the same basis. I do not think, however, that a customer in a different line of business, but who otherwise presents the same conditions, should be given the benefit of the special rate. Such a customer is not actually damaged by its existence. A special rate is an excrescence to be gotten rid of as soon as possible and not multiplied or fostered.

This question has been passed upon by some of the state commissions. The Massachusetts Gas and Electric Light Commission, in its investigation into the rates of the Boston Edison Company in 1907, declined to interfere with special contracts. In its opinion, the Commission said: "The matter of special rates and the company's declared policy with relation thereto have already been mentioned. There can be no possible justification for the company to depart from its published schedule of prices, or to give any advantage, directly or indirectly, to one customer not offered to others enjoying or seeking the company's service under like conditions. The Board recommends that the practice be discontinued as promptly as may be consistent with the *fulfillment of existing contracts* which cannot legally be cancelled."

It may be that all contracts made by a public utility are subject to avoidance by the rate-regulating power of the state, and that the parties contract with reference to this fact. This is the view of the New York Public Service Commission (First District) as declared by it in its decision of April 10, 1912, *in re* Rates of Bridge Operating Company Case, 1461.[2] Here an agreement was entered into between the New York City Bridge Commissioner and the Bridge Operating Company, which provided for a certain rental, and authorized the company to charge a rate of fare of three cents for a single ticket, and five cents for two tickets. In a proceeding instituted by the Commission to fix reasonable rates and fares, it was claimed that this contract could not be altered by the Commission without the consent of both parties, and that any order directing a reduction of fares below such rates would be illegal as violating the provisions of the state and federal constitutions.

The Commission held that the power to regulate rates and charges of a public-service corporation was an inherent power of the state, and that parties entering into contracts affecting the affairs of public-service corporations must recognize that any agreement, which they may make, cannot restrict the powers which belong to the state, and if the provisions of such a contract thereafter come into conflict with such powers of the state, the contractual provisions must be deemed to have been made in view of the possible exercise of the rights reserved by the Legislature, and must therefore give way.

The decision does not state whether the reduction of fares ordered entitled the company to a reduction in the amount of the rentals it was required to pay to the city. It is to be assumed that if the contract was subject to future regulation by the state in the matter of fares, it was likewise as to rentals.

The contract in this case was not apparently a franchise, but a mere operating agreement. The Bridge Operating Company has since taken the matter into the courts.

The Railroad Commission of Wisconsin, in reply to my inquiry as to how in readjusting rates for public utilities, it has dealt with outstanding contracts which provided for rates that were lower than the rates fixed by it, wrote me under date of July 30, 1910, as follows: "We frequently meet with such contracts as those you have in mind. They were encountered in the La Crosse, Madison and many other cases we have had to pass upon. If the rates provided by such contracts are not too far out of the way, or if they are not so low as not to yield something above operating expenses, and are as high as the rates upon which the business can be had, and at the same time are not unjustly discriminatory, they are usually permitted to stand until the contract expires, or until there is a change in the conditions upon which they depend. Where no questions of unjust discriminations are involved and where the business cannot be had on better terms, we usually take the position that it is best for all concerned to keep the business that will yield something in the way of returns for interest and profit, than not to have it at all. This has been more or less fully explained in various decisions, although there has been no formal ruling in the matter."

[2] Public Service Commission Reports, First District, N. Y., Vol. III, page 226.

Rights and Status of an Electric Company Engaged in an Interstate Business.

There is no doubt of the right of a public-service company to transmit electricity beyond the state, and thereby engage in interstate commerce. The United States Supreme Court held in Haskell vs. Kansas Natural Gas Company, 221 U. S., 229, (affirmed on rehearing on April 1, 1912) that natural gas after severance from the earth, was a commodity which might be dealt in like other products of the earth, and was a legitimate subject for interstate commerce, and that no state could prohibit its transportation in interstate commerce beyond the limits of the state.

In Interstate Commerce Commission vs. Goodrich Transit Company, and United States vs. White Star Line (Decided by the United States Supreme Court, April 1, 1912), it was held that the Interstate Commerce Act, as amended, provides that any carrier engaged in the transportation of passengers or property, partly by railroad and partly by water, when both are used under a common control, management or arrangement for a continuous carriage or shipment, is subject to its provisions.

The carriers in question carried on a purely state business, an interstate business, and a joint rail and water business. The White Star Line also conducted amusement parks at Tashmoo and at Sugar Island. Less than 20 per cent of the Goodrich Company's gross earnings was derived from its joint rail-and-water business. Less than one per cent of the entire revenue of the White Star Line was derived from its joint rail-and-water business.

The Commission prescribed a uniform system of accounting and bookkeeping for carriers by water upon the Great Lakes. The boat companies claimed that they were only required

by law to report to the Commission their joint rail-and-water business.

The Supreme Court held that the Interstate Commerce Commission did not exceed its authority in the matter, because the accounting system and reports prescribed by it were not limited to the joint rail-and-water business, but embraced as well the other business of the carriers. The Court held that if the Commission was to successfully perform its duties, it must be informed as to the business of the carrier by a system of accounting, which would not permit the possible concealment of forbidden practices in accounts, which it was not permitted to see and concerning which it could acquire no information, and that the carriers were bound to report to the Commission upon all of their business, although the Commission had jurisdiction over only a portion of it.

The converse of the proposition decided by the Court in this case must be equally true. If the Interstate Commerce Commission may require uniform accounts, which will show all the business of a carrier, both state, interstate and joint rail-and-water, for the purpose of enabling it to inform itself as to the interstate commerce over which only it has jurisdiction, then it must be equally true that a state commission (such as our Michigan Railroad Commission) has authority to require carriers to make reports to it covering both state and interstate business, to enable the Commission to inform itself as to the state business of the carrier.

It is equally true that a public-utility Commission, in order to fully exercise its jurisdiction over electric light and power companies, may require such companies to report to it, and to keep uniform accounts which will cover every phase of their business, both state and interstate, and whether private or public in its nature. This subject may hereafter become of importance in the case of companies which operate in cities and communities on the border of the state, or in the case of companies engaged in other lines of business than the distributing of electricity alone.

Peninsular-Power-Company Case.

A case of much interest to those hereafter incorporating public-utility companies under the laws of foreign states, for the purpose of doing business in Michigan, is that of the Peninsular Power Company.

This company was incorporated May 9, 1911, under the laws of Wisconsin, for the purpose of acquiring lands in Michigan and Wisconsin on each side of the Menominee River, and also certain water rights in each of these two states. On June 1, 1911, it applied to the Wisconsin Railroad Commission for approval of its stock issues amounting to $750,000.

With $600,000 of this stock it acquired the properties in question from the Twin Falls Land Company, a Michigan corporation, composed of practically the same stockholders as the Peninsular Power Company. The Twin Falls Land Company had acquired these lands for about $100,000. The laws of Wisconsin provided that no license, permit or franchise to own, operate, manage, or control any plant for the production, transmission, or furnishing of light or power should be granted or transferred except to a Wisconsin corporation. This statute undoubtedly prompted the organization of the Peninsular Company under the laws of Wisconsin.

The company then applied for a license to do business in Michigan, which was refused by the Secretary of State, until the company had obtained the approval by the Michigan Railroad Commission of its original issue of stock. The company denied the right of the Secretary of State to make this requirement, claiming that our statute of 1909 applied only to the issue of stock and bonds proposed to be issued by a public-utility corporation organized under the laws of Michigan, or one organized under the laws of another state and *already authorized* to do business in Michigan.

The company thereupon applied to the Michigan Supreme Court for a writ of mandamus to compel the Secretary of State to accept and file its papers and accept payment of the proper franchise fee. That the Supreme Court denied on April 11, 1912, holding that the Act of 1909 applied to foreign public-utility corporation *desiring to be admitted* to do business in Michigan, and that the permissive certificate of the Michigan Railroad Commission must be obtained before the Secretary of State could license such a corporation to do business in this state.[3]

The Peninsular Company then made the necessary application to the Michigan Railroad Commission for the approval of its original stock issue of $750,000, and also, of certain preferred stocks and bonds.

The Commission found itself embarassed by the fact that the issue of the stock in question had already been approved by the Wisconsin Commission, and had been actually issued in the belief that such approval was the only preliminary legal requirement. The proofs showed clearly that lands originally acquired for $100,000 had been capitalized for $600,000. The Commission concluded under the circumstances to approve the transaction for the present, without being bound in the future by the valuation placed upon the physical properties by the company, if such value should hereafter become a pertinent subject of inquiry, and the certificate required by law was accordingly issued.

The opinion filed by Commissioner Hemans is interesting in its bearing upon the question of valuation and capitalization. The Commissioner's opinion is in part as follows: "In view of the fact that the statute under which this Commission acts in passing upon stock and bond matters, requires it to find and certify that the stock or bonds asked are reasonably acquired for the purposes of the corporation, and the Commission have a reasonable discretion to exercise, it can readily be seen that the foregoing facts present several features of embarrassment; to deny the petition is to ignore the comity that should exist between Michigan and a sister state; it would jeopardize the financial interests of many stockholders who have now invested their savings with an honest purpose and with the legal sanction of the agencies created for the supervision of such matters in the state where until now corporate rights have been exercised, while to grant the application is to put the seal of approval upon the method of valuation by which the property of the Twin Falls Land Company, which was purchased as a physical asset for $100,000, was turned over to a separate corporate entity, but composed of practically the same stockholders, at a price of $600,000.

"Because it had not been judicially determined that a foreign corporation came within the provisions of the stock and bond act of Michigan until the present case, we feel justified in granting the order authorizing the filing of the articles of association in the particular case; without, however, being bound by the valuation of $600,000 which has been placed upon the property acquired from the Twin Falls Land Company, and in this connection it is perhaps due the petitioners to say that they justify this transaction upon the claim that the property which they acquired from the Twin Falls Land Company had, when taken over by the Peninsular Power Company, an actual value of more than $600,000; that the cost of the property upon the open market is a negligible factor in determining its actual worth. Expert testimony has been adduced showing the probable cost of the development of the property, the amount of power that can be produced, the market that is ready to take it, and for which tentative contracts have already been made. It is contended that the price proposed to be charged is less than the price at

[3] Peninsular Power Company vs. Secretary of State, 19 D. L. N., 184.

which power can be produced by steam and it is argued that the proposed price is therefore a fair price.

"From all these facts a computation is made showing a return upon a much larger capitalization than the company has, and therefore the deduction is made that if the property can be made to yield a return upon a capitalization including a value of $600,000 upon the properties acquired from the Twin Falls Land Company, that the property must in fact have a value of $600,000. This argument is one frequently made in the capitalization of properties of this character and is supported by a certain measure of plausibility. The water-power statute enacted by the Wisconsin Legislature of 1911, and recently declared unconstitutional by the Supreme Court of that state upon another phase of the law, in one of its sections used the value of power produced by hydroelectric means, but can this method of determining the value of a public utility be justified? We do not think it can.

"The value which is sought to be capitalized in such cases accrues not from the value of the natural elements employed, purchased upon the open market, but from the monopolistic character of the business transacted. The spirit of recent legislation, including the stock and bond act in Michigan, is to eliminate this factor as the essential basis for capitalization of public-utility corporations — that is, where fair competition in the things which the general public as such must buy is eliminated, either by restrictions imposed by natural conditions or by franchise which the public grants, the excess of demand thus created of the corporation possessing the favorable franchise, or natural advantage, should not be allowed to result to the disadvantage of the general public and to the special advantage of the corporation controlling the right which the public have created or granted.

"We would not be understood as saying that the property acquired from the Twin Falls Land Company did not have an actual value in excess of $100,000. To the value of the property bought upon the fair market, that corporation had both the moral and legal right to add legitimate sums for the ability and energy that brought the properties together for promotion and profit such as would be recognized in any other field. These are factors capable of measurement and actual valuation. The principle which we do not recognize is the claimed right of a public-utility corporation to capitalize its exclusive privileges and to give to the elements it employs in the serving of the public, values which they do not have in other fields of effort. Because of these considerations, this Commission will not be bound by similar valuations disclosed in future applications by either domestic or foreign corporations, nor will it be bound by the valuations placed upon the physical property in this case by petitioners if, at any future time, the value of the corporate property of this company should become a pertinent subject of lawful inquiry before this Commission."

Hereafter when a public-utility company proposes to do business in two states, it will have to make simultaneous applications in both states for the approval of its securities, in order to avoid the embarrassing situation in which the Peninsular Company found itself.

Public Service Commissions

NEW YORK.

The Public Service Commission, Second District, and its engineers have been in consultation and continuous correspondence with representatives of Stone & Webster, who have the management of the Adirondack Power Corporation properties, to the end that that property may be put in first-class condition and further interruptions to service obviated. Financial and legal difficulties which have taken some time to adjust have delayed the working out of the plans as rapidly as expected. The company has already spent $75,000 and has plans for spending upwards of $500,000 more.

The Commission has authorized the Catskill Illuminating & Power Company, the Schoharie Light and Power Company, the Upper Hudson Electric Light & Railroad Company to consolidate and form a new corporation to be called the Upper Hudson Electric and Railroad Company. Before the consolidation is finally accomplished the Schoharie Light & Power Company is authorized to purchase the property of the Cairo Electric & Power Company. The matter of the consolidation of these properties has been before the Commission for some time, during which a comprehensive investigation of the financial affairs and physical properties of the companies was made by the accounting and engineering experts of the Commission. Before allowing the consolidation the Commission required the wiping out of $18,000 of the capital stock. The total capital stock of the consolidated companies was $250,000, of the Cairo Company, $80,000. The authorized capital stock of the new corporation is $150,000. A further condition of allowing the consolidation is that the obligations of the consolidating companies will be refunded so that the total will be $415,734.59 and of this amount 22 per cent shall be delivered to the stockholders of the Catskill Illuminating & Power Company, 35 per cent to the Schoharie Light & Power Company and 40 per cent to the Upper Hudson Company, and that the capital stock of the consolidating companies to the amount, par value, of $250,000 shall be cancelled.

The Upper Hudson Company is authorized to make and execute a first mortgage upon all of its plant and property and to issue five-per-cent, 30-year gold bonds to secure an aggregate amount of $1,500,000.

The Commission has authorized the Northern Wayne Electric Light & Power Company to exercise franchises for the furnishing of electricity to Fairhaven, Sterling and Sodus in Cayuga and Wayne Counties. The Commission has also authorized this company to place a mortgage upon all its property and franchises to secure the payment of bonds to the aggregate amount of $150,000.

The Commission has authorized the Northern Power Company to exercise franchises granted by the towns of Oswegatchie and Lisbon, St. Lawrence County, for the furnishing of electricity in these two towns.

The Commission has approved the following types of two and three-wire single-phase induction watt-hour meters: Fort Wayne Type K4, General Electric Type I-10, Sangamo Type H, Westinghouse Type OA.

SMALL CENTRAL-STATION METER PRACTICE.

Polyphase Meters.

By Guy R. Grove.

With the advent of the adoption of multiphase circuits for power purposes among the smaller central-station companies, comes the problem of keeping these meters in proper calibration. Unfortunately, there are few metermen working for the smaller companies who understand polyphase meters. They seem to think that the subject is too deep for them and are content to master only the single-phase meters and consequently the power meters are not given the attention they should have to keep them in proper calibration. As a matter of fact, a meterman who thoroughly understands the principle of the single-phase meters should have but little trouble mastering polyphase meters.

Companies having enough lighting meters on their lines to maintain a full equipment for testing single-phase meters can use these same instruments with good results for testing polyphase meters. The rotating-standard instrument is the most convenient and is more accurate in the hands of the ordinary tester than the use of an indicating wattmeter and a stop watch, as it eliminates the error in reading the scale and watch, and variations in loads, besides being more rugged.

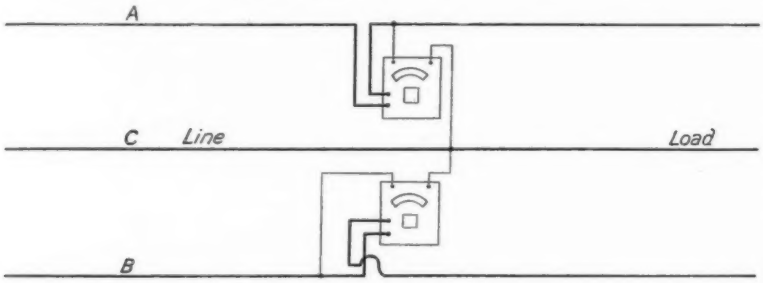


Fig. 1.

The energy expended in a three-phase circuit can be accurately measured by two single-phase recording or indicating meters when connected in the circuit as shown in Fig. 1. In this case the sum of the readings indicates the total consumption.

Fig. 2 shows how the energy can be measured by three separate meters, but in this case one side of each shunt coil is tapped to the neutral point of a star-connected circuit, or to the neutral point of an artificial star resistance, if the delta-connection is used. The sum of the three wattmeter readings indicates the true watts.

When the three-phase was first used, two separate recording meters were used as shown in Fig. 1, but on account of the confusion in reading the dials, this scheme was not used much. The three-phase meters were then built, and consist simply of two single-phase meter elements acting on one disk, or two disks which are rigidly connected to one shaft, both elements registering on one dial. When calibrating the meter, both elements can be tested together as one meter, or each element can be tested separately, considered as two single-phase meters. Fig. 3 shows the conventional method of representing the current and voltage relations in a three-phase circuit.

Assuming that the principle of the single-phase induction meter is understood, the current and voltage relations in the two elements of a polyphase meter at different power-factors will be shown by diagrams. In these diagrams, *A* and *B* represent the outside wires and *C* the inside wire of a three-wire, three-phase circuit. *a*, *b* and *c* represent the line currents; *OE* represents the line voltage across each meter element; *OX* the current in the shunt circuit and *OC* the current in the series coil. *OX* and *OE* are supposed to have a 90-degree phase relation.

Fig. 4 shows the phase relations between the current and potential of each element of the meter when operating on a three-phase circuit at unity power-factor. One element has its series coil in *A* and its potential coil across *AC*, and the other element has its series coil in *B* and its potential coil across *BC*. From the diagram it will be seen that the current *a* is displaced 30 degrees from its shunt *OX*, and the current in *b* is displaced 30 degrees in the opposite direction from its shunt, giving the effect of a leading current in phase *A* and a lagging current in phase *B*. It is thus seen that each element of a polyphase meter is operating at a single-phase power-factor equal to the cosine of 30 degrees, or 86 per cent, with noninductive load. In this case both elements will operate at the same speed, but this condition of power-factor is seldom met with in actual power installations.

Fig. 5 shows the relations existing when the power-factor of the three-phase circuit is 86 per cent or the angle of lag is 30 degrees. It will be seen that the current in one series coil will be in phase with its shunt coil and the current in the other series coil will be out of phase 60 degrees. Under this condition, one element will run about twice as fast as the other, but in the same direction.

Fig. 6 shows the relation when the current lags 60 degrees or the circuit is operating at 50-per cent power-factor.

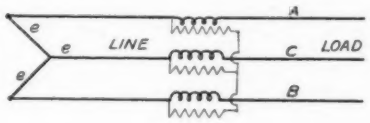


Fig. 2.

It will be noted that with this condition, the current relations in one element of the polyphase meter will be 90 degrees and there will be no rotation, and the other element will operate with a phase difference of 30 degrees.

It is easily seen now why one element or meter on a polyphase circuit will not run at all, or run so much slower than the other element or meter. If the power-factor drops below 50-per-cent (or if the angle of lag is more than 60 degrees), one element will run backwards. When it is found that one element runs backwards, it is often erroneously assumed that that particular element is connected wrongly.

Fig. 7 shows the relations when the angle of lag is 90 degrees. It is seen with this lag that one element will tend to rotate forward as fast as the other element tends to rotate backwards and consequently the meter, as a whole, will not rotate at all. This is as it should be, as with an angle of lag of 90 degrees the power-factor is zero and no energy is expended.

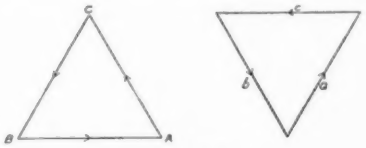


Fig. 3.

Installation of Polyphase Meters.

Great care should be taken when installing power meters to see that they are not hung on walls subject to vibration, which roughens the jewel bearing and soon affects the accuracy of the meters.

The diagram of connections sent out with the meter should be followed closely. This is very important, as it is possible to make incorrect connections introducing excessive errors on inductive loads, and still have the meter rotate in the proper direction. If it is

definitely known that the power-factor of the circuit is above 50 per cent, a test to see if the proper connections are made can best be done by alternately opening the shunt circuit of each element and noting whether or not the meter runs forward on both of the tests.

If it is not definitely known what the power-factor is, a test can be made as follows: Connect the meter as shown in Fig. 8. (*A*), then disconnect the shunt coil of element on *A* phase from *C* and connect it across *AB*. Note readings before and after change, and if the power-factor is above 50 per cent, the reading will differ, but be in same direction, either positive or negative. If power-factor is less than 50 per cent, the readings across *AC* and *AB* will be

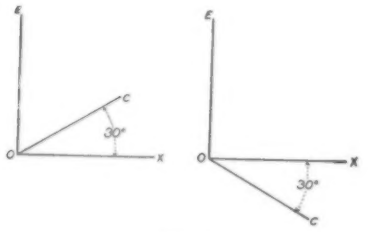


Fig. 4.

reverse in direction with respect to each other.

A test can be made on the *B* element

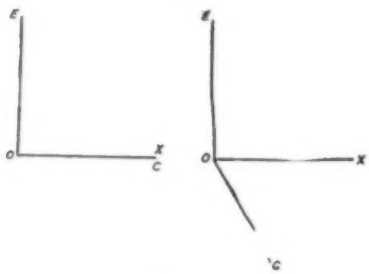


Fig. 5.

in the same way. If it is found that the power-factor is between 50 and 100 per cent, both elements should run forward; if below 50 per cent, one element should read backward, but the element having the largest reading should be forward.

The inaccuracy in registration due to wrong connections of polyphase circuits is not generally realized by those not thoroughly familiar with polyphase meters. For instance, suppose in Fig. 8 the shunt element in *A* phase is wrongly connected across *AB* as in Fig. 9 instead of across *AC*. Figs. 10 and 11 show the relative relations of the circuits and voltages if a meter is connected in this way. It is easy to see that the effect of this connection is to make both elements of the meters to run in the same direction and at the same speed, regardless of the power-factor. This mistake should be carefully guarded against as it is easy to see that it cannot be detected by the common method in use of opening the shunt side of each element at a time and noting if both elements run forward.

Testing Polyphase Meters.

For the smaller central stations, the

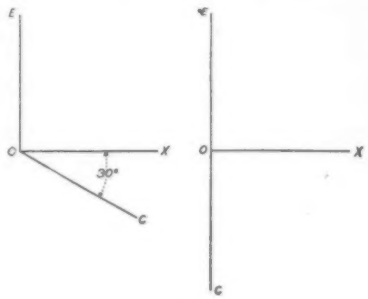


Fig. 6.

most convenient method for testing power meters is to use the rotating standard. Besides being most convenient, it is a more accurate method than to use an indicating wattmeter, as it eliminates the errors due to variations in the load while taking readings. Probably the most common method of testing these meters is to connect the series coils in series and the shunt coils in parallel and test as a single-phase meter, and the same adjustments apply. The connections for testing a self-contained meter, using a rotating standard, is shown in Fig. 12. When this method is followed, the line not used should be closed by a jumper, as shown, and care must be taken so as not to overload the series coil of the standard and damage the meter. The figure shows a very simple scheme of protecting the standard from an abnormal current. A single-pole, single-throw switch is

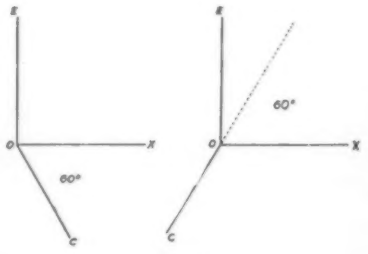


Fig. 7.

mounted on a wooden base and is provided with four lugs. The switch is connected as shown and the wires coming from the line are connected to the two lugs on one side of the switch by set screws in the lugs and the wires to the standard are connected to the two lugs on the other side of the switch. The switch is closed until the load is adjusted so as to be under control and then opened, allowing the current to flow through the standard. This arrangement can be used with large-capacity, self-contained meters, the switch being connected into the circuit during the noon hour, and by using two such switches, the standards can be changed as often as desired without an interruption of the circuit.

When testing the meter with the series coils in series and the shunt coils in parallel, the testing constant of the meter under test must be halved. In testing or calibrating with a rotating standard, it is merely necessary to know the watt-hours per revolution of the disk to test any kind of a meter. As all manufacturers of meters do not express the constants of their meters in the same way, it is necessary to find the watt-hour per revolution of

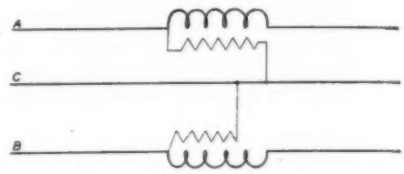


Fig. 8.

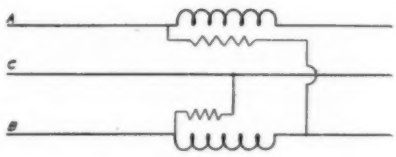


Fig. 9.

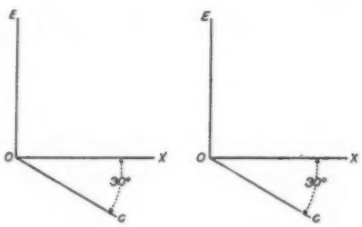


Fig. 10.

the disk in order that it may be calibrated with the standard. Instructions for obtaining these constants are usually sent out with the meters so that but little trouble is experienced in getting this information.

In all tests of polyphase meters, both potential coils must be connected to the circuit and energized and should be given the same tests on light and full loads as when testing single-phase meters, and the same adjustments apply. The shunt coil of the standard should be so connected that the meter will run forward when testing either element, if the power-factor is above 50 per cent, and with a power-factor of less than 50 per cent, the meter should run backward on one element and forward on the other.

If a polyphase meter is to be in-

stalled on a job where the power-factor is definitely known, the meter should be tested and lagged for that power-factor before it leaves the shop. If it is not definitely known, the meter should be tested in the shop on light load and on heavy load with power-factors of 25, 50 and 75 per cent, which is generally sufficient. This requires some arrangement in the shop for varying the power-factor on a single-phase circuit.

While there are several methods in use, the writer thinks the method shown in Fig. 13 is by far the most simple and yet accurate enough for all commercial uses. All that is required is a three-phase service, bank of lamps, ammeter, voltmeter and an indicating wattmeter. The indicating wattmeter is not even necessary, as the rotating standard can be used for finding the true watts by timing the revolutions of the disk. The true watts then equal revolutions of disk, multiplied by disk constant, multiplied by 3,600 and divided by the time in seconds. Dividing the true watts by the volt-amperes as indicated by voltmeter and ammeter readings gives the power-factor within five per cent, which is close enough for all practical work. The power-factor can be varied to any value by simply changing the load.

With connection as shown in Fig. 13, power factor $= (I_a - I_b)/2I_c$

Power-factors from 0.0 to 0.5 can be obtained by this connection. For power-factors from 0.5 to 1.0 the potential coil of meter is changed from across *A B* to *A C*. Then the power factor is equal to

$$(2I_a + I_b)/2I_c$$

When testing polyphase meters furnished with series transformers, the one-ampere coil of the rotating standard should not be used unless it is definitely known that the load is within the capacity of the one-ampere coil. When a meter with transformers is tested as a single-phase meter, with the series coils in series and the shunt coils in parallel, the secondary circuit of one of the transformers must be short-circuited and disconnected from the meter. The test constant of the polyphase meter must then be divided by 2 and the test constant of the rotating standard must be multiplied by the ratio of the series transformer.

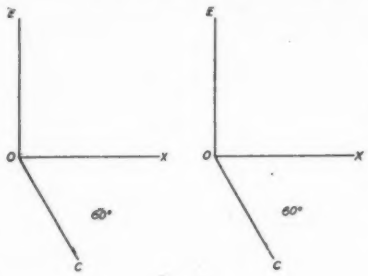


Fig. 11.

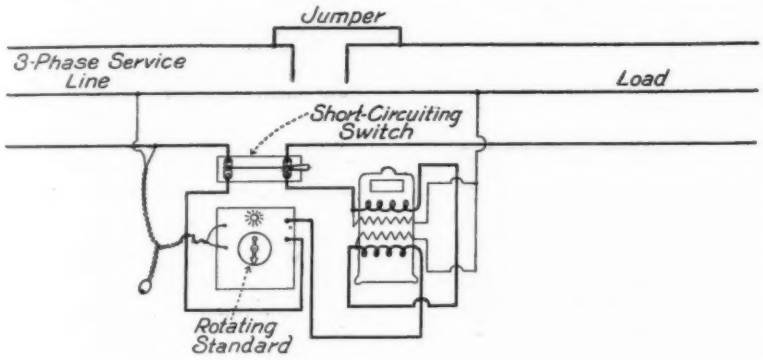


Fig. 12.

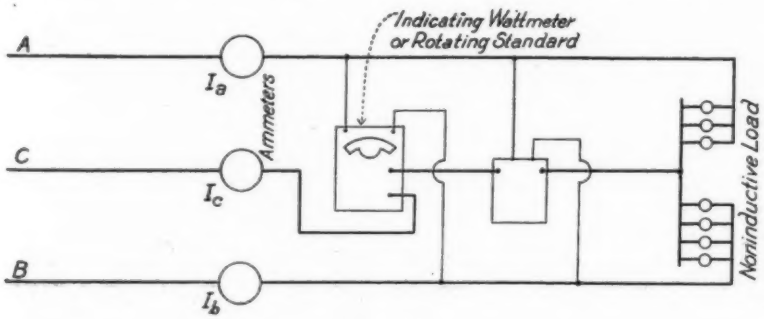


Fig. 13.

Suppose, for example, it is desired to test a 120-ampere, 220-volt, three-phase Westinghouse, type C meter with a rotating standard, by connecting the series coils in series and shunt coil in parallel. The ratio of the current transformer is 120:5 or 24:1. The testing constant of the polyphase meter is 32/2 =16. The constant of the standard is $0.666 \times 24 = 16$. Hence the percentage of registration will be 16 times the number of revolutions of meter under test divided by 16 times the number of revolutions of standard meter.

It is becoming the standard practice to furnish all polyphase meters having a capacity of 100 amperes or above with series transformers, as it is then possible to increase the metering capacity by simply changing the transformers. Meters installed with series transformers should be correctly calibrated with respect to the energy in the primary circuit and this calibration can be obtained directly by connecting the standard in the primary circuits of the transformers. This is called a primary test.

The phase displacement between the primary and secondary currents of series transformers used with wattmeters is of sufficient importance to warrant it being considered separately, as the accuracy of the wattmeter is greatly dependent on the phase displacement of the transformer with which it is operating.

In most transformers the secondary is leading, and the effect is to make a wattmeter read high on inductive loads, while not affecting noninductive-load readings. In well designed transformers the phase displacement is seldom more than two degrees when operating under normal conditions. The introduction of one or two additional instruments, having some reactance in their windings, in the secondary circuits of a transformer, will change the value of the phase displacement.

Watt-hour meters used in conjunction with current transformers and ordered from the makers so equipped are properly calibrated with the transformers on unity and a low power-factor before they leave the factory. If these meters are used with other transformers, the manufacturers do not guarantee their accuracy. From what has been said it is apparent that when a meter has been properly calibrated and lagged for a certain power-factor it will not be accurate when used on any other power-factor unless it is recalibrated by relagging the meter. When it is desired to change the transformer or vary the load, the meter should be calibrated under the new conditions, and this is enforced by all manufacturers. Due to the fact that the phase displacement increases as the load

decreases, it is obvious that the meter cannot be calibrated or lagged to register accurately on all loads and should be properly calibrated for use on the load used most of the time.

From what has been said of the variations of the phase displacement of series transformers when used with different inductive loads, it is easy to see that the error due to this cause is a very important one.

When conditions are such that a primary test is impossible on large installations, secondary tests may be made. Secondary tests, however, can only be made when the transformer errors are determined and are taken account of in the calibration of the meter. The transformer may be tested in the laboratory previous to installation and a correction curve drawn.

With standards in the primary circuit, the meter is adjusted correctly at unity power-factor by means of full-load and light-load adjustment, if load can be obtained, after which the meter is tested on one or two loads at a low power-factor and its accuracy adjusted to 100 per cent by altering the lag adjustment.

In testing the meter by means of standards in the secondary circuit, it is necessary to have a correction curve for the transformer on both unity power-factor and at a low power-factor. The meter is then adjusted and lagged the same as on a primary test except that the percentage of accuracy is adjusted in each case to conform to the corresponding calibration or correction curve. If a current transformer is also used in connection with the standard in making a primary test, a correction curve for that transformer must also be used and its error taken care of by adding or subtracting to or from the standard readings.

It is often desirable to find the power-factor of a three-phase circuit and when it is not convenient to use the ammeter, voltmeter and indicating wattmeter, the approximate power-factor can be figured from the watt readings of the two elements of the service meter. From the preceding diagrams, showing the difference of speed of the two elements in a polyphase circuit, it is evident that these variations are due directly to the changes of power-factor in the circuit.

The size of the installation and number of kilowatt-hours used per month determine the frequency of tests on polyphase meters. In small installations, one test per year is enough. In large installations, a secondary test should be made at least every two months and a primary test at least once a year, and also whenever a change of load is made which may change the power-factor of the circuit.

THE CONTROL OF MOTOR-DRIVEN VENTILATING FANS.

By George J. Kirchgasser.

Motor-driven fans are used for ventilating factories, offices, stores, schools, churches, hotels, hospitals, restaurants, etc. They are also used in connection with steam-heating systems, in industrial plants for the removal of refuse, and in chemical laboratories, etc.

For a few purposes a single fan speed is satisfactory and in such cases the fan motor may be thrown across the line or else started by means of a manually operated starting rheostat. If it is desired to start a fan of this kind from a remote point, a switch of sufficient capacity may be employed, or a push-button station, which, when operated, closes the magnetizing circuit of a magnetic switch.

For most cases of ventilating-fan applications, however, it is desirable and also required that speed variation be

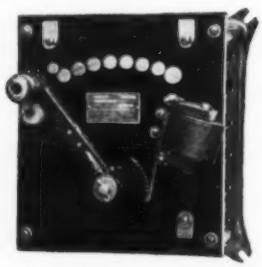


Fig. 1.—Wall-Type Fan Speed-Regulating Rheostat.

obtained. Speed regulation can be provided by means of manually operated regulators or automatic types, which can be controlled from a remote location or from several such points.

Speed variation is desired in most cases because of varying conditions. In a theater, school, hall, etc., the number of people present affects the amount of ventilation required. In the industrial plant, chemical laboratory, etc., the amount of smoke, gases and vitiated air varies during periods of the day.

Speed regulators may be described as starting rheostats with sufficient resistance to carry the full-load current continuously on any step. The resistance of rheostats designed merely for starting a motor is seldom required to carry current for a period of more than 15 seconds. The resistance of speed regulators, on the other hand, when used in connection with machine tools, may be required to carry current continuously during the working hours of the day, and when used with fans or pumps may be employed nights as well. The amount of resistance incorporated in rheostats designed for speed regulation must, therefore, be ample to carry full-load current for long periods of time.

The speed regulation of shunt-wound and compound-wound direct-current motors may be effected in two ways; by inserting resistance in the armature circuit of the motor, or by inserting resistance in the shunt-field circuit. The first method reduces the speed of the motor below its normal rated speed, the amount of speed reduction obtained depending partly upon the amount of resistance introduced into the armature circuit and partly upon the load on the motor. The second method increases the speed of the motor above normal, the amount of speed increase depending only upon the amount of resistance used, and not at all upon the load on the motor. By a combination of the two methods described, the speed of a motor may be both decreased below and increased above normal speed, thus affording a wide range of speed variation. There are standard speed regulators, in which speed variation is effected by armature resistance only, by shunt-field resistance only, and by a combination of shunt-field and armature resistance.

In installing regulators it must be remembered that "fan-duty" requirements are different from "machine-duty" controlling requirements. By "fan duty" is meant any duty similar to the driving of a ventilating fan, or in other words any class of service in which the turning effort, or torque, increases or decreases with changes in speed. In regulators designed for fan duty, the capacity of the resistance is tapered in proportion to the amount of resistance inserted, being reduced to approximately one-half the normal full-load current capacity when all resistance is in circuit. Sufficient resistance is provided in fan-duty regulators to cause a 50-per-cent drop in voltage with this reduced current flowing, the resistance being relatively higher in ohms and lower in ampere capacity than the resistance provided with speed regulators designed for machine duty. Hence, should a fan-duty regulator be used for machine duty with a normally loaded motor, the percentage of speed reduction obtained would be greater, but there would also be great danger of overloading the resistance and possibly destroying the rheostat.

The power required by some kinds of motor-driven machines when running at slow speed is less in proportion to the reduction in speed than in other classes of machines, some of which take almost as much current when operating at one-half speed as at full speed. Typical examples of the two classes of machines referred to are furnished by a ventilating fan and an hydraulic pump, the current required to

operate the fan becoming less and less as the speed of the fan is diminished, while in the case of the pump about the same current is required to operate it at half-speed as at full speed.

Speed regulators designed to operate a motor at various speeds below normal, but not to increase its speed above normal, are provided with armature resistance only. The resistance provided will carry the normal current continuously on any step without overheating and when all resistance is in circuit will reduce the speed of the motor 50 per cent, provided the motor is taking its normal current. If the motor is not taking its normal current the amount of speed reduction will be correspondingly less. Figs. 1 and 2 illustrate an extensively used manually operated fan-motor regulator and a type for use with large-capacity fans.

When operating *without* resistance in the armature circuit, shunt-wound and compound-wound motors will inherently regulate to approximately constant speed, regardless of load. This characteristic of inherent regulation is lost, however, when armature resistance is employed to reduce the speed of the motor, fluctuations in load resulting in fluctuations in speed, which become more noticeable as the amount of resistance inserted in the armature circuit is increased. With all resistance in circuit and the motor taking

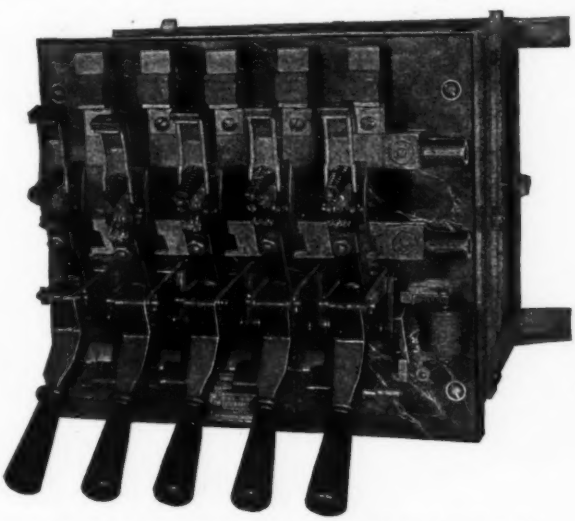


Fig. 2.—Multiple-Switch Type Regulator for Large Fans.

normal current, the speed will be reduced to 50 per cent, but should the load current drop from normal current to one-half normal current, the speed of the motor will increase from 50 per cent to 75 per cent of normal speed. In other words, the resistance is proportioned for normal current conditions and will give the calculated speed reductions only so long as the load on the motor is unchanged. Any changes in load will result in a corresponding change in speed and it then becomes necessary to move the lever of the speed regulator forward or back to again obtain the speed at which the machine was operating before the load on the motor changed. With ventilating fans this does not occur as the load does not fluctuate.

When the speed of a motor driving

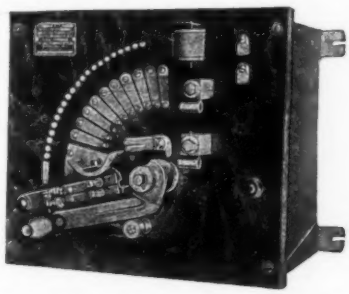


Fig. 3.—Combination Starter and Regulator.

a constant-torque machine is reduced by inserting resistance in the armature circuit, there is no corresponding reduction in current consumed. The motor runs more slowly simply because a part of the energy impelling it is shunted into the resistance and there dissipated in the form of heat. Hence, whether the motor is operating at full speed or half speed, the amount of current consumed is the same; the only difference being that in one case all the energy taken from the line is expended in driving the motor while in the other case only one-half the energy is utilized for power, the other half being dissipated in the resistance.

Speed regulation by armature resistance only is, therefore, open to two objections: first, the difficulty of maintaining constant speed under varying load conditions and, second, the necessity of wasting energy to secure speed reduction. These objections are in part offset by the fact that speed reduction by armature resistance may be applied to any motor of standard design and requires nothing more than the simplest and least expensive speed-regulating rheostat. In cases where the motor will be operated nearly always at full speed and only occasionally at less than its normal speed, the difference in first cost of the installation may justify the use of the armature-resistance method of control. In the case of a motor-driven fan, as the current decreases with the speed, armature-resistance control finds one of its best applications, as little current is wasted.

Speed regulators designed to operate a motor at various speeds above normal, but not to reduce its speed, are provided with regulating resistance in the shunt-field circuit only. Some resistance in the armature circuit is also necessary in order to properly accelerate the motor from rest to normal speed, but the carrying capacity of the armature resistance provided in rheostats designed for shunt-field regulation is comparatively small and can-

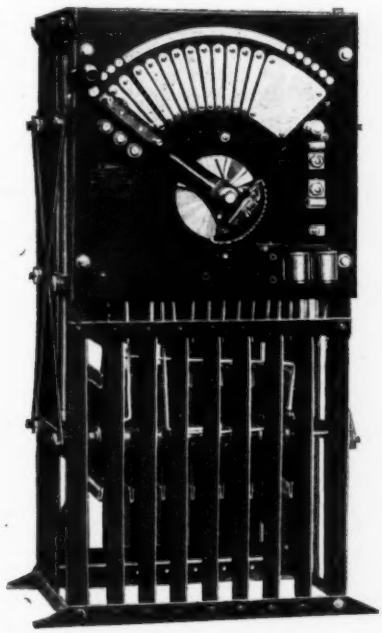


Fig. 4.—Armature and Shunt-Field Type Regulator, 25 to 50 Horsepower.

not be used for reducing the speed of the motor. A type of such regulator is illustrated in Fig. 3. The armature resistance is of capacity for short starting duty only in this type.

The weakening of the shunt-field by the insertion of resistance in the shunt-field circuit causes the armature to revolve more rapidly. The advantages of this method of control are that the motor will inherently regulate to approxi-

mately constant speed under widely varying load conditions; and all the current taken from the line is utilized for power, the changes in speed being obtained, not by dissipating a portion of the effective energy in the resistance (as in the case of the armature-resistance method of control) but by weakening the counter electromotive force by inserting resistance in the shunt-field circuit.

Speed increase by means of shunt-field weakening is limited, however, to about 10 to 15 per cent above the normal speed in motors of standard construction. Greater ranges of speed can be obtained from motors especially designed for shunt-field control, but should not be attempted with motors of standard design without first ascertaining from the manufacturer the maximum speed at which the motor may be safely operated.

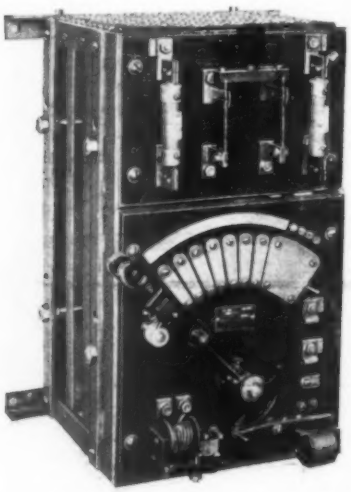


Fig. 5.—Armature and Shunt-Field Type Regulator with Overload and No-Voltage Release.

Speed regulators designed to reduce the speed of a motor 50 per cent below normal by armature resistance and to increase it 25 per cent above normal by shunt-field resistance provide means for obtaining a wide range of speeds. Assuming the normal speed of a fan motor to be, for instance 1,000 revolutions per minute, it is possible by the armature-resistance method of control to vary the speed between 1,000 and 500 revolutions per minute. By the shunt-field method of control the speed range is limited to between 1,000 and 1,250 revolutions per minute, but by installing speed regulators of the combined armature and shunt-field-control type, the speed of the motor may be varied from a minimum of 500 to a maximum of 1,250 revolutions per minute. Figs. 4 and 5 illustrate regulators for this purpose.

Eighty-five per cent is about the maximum speed reduction obtainable by armature resistance, but so great a reduction is seldom satisfactory, since comparatively slight increases in the load will cause the motor to stall. Fifty per cent or one-half speed reduction is the usual amount. Shunt-field regulation may be obtained up to any point for which the motor is suited, the only limitation in this case being the maximum speed at which the motor may be safely operated.

It should always be remembered, however, that speed increase by shunt-field weakening increases the current in proportion to the increase in speed and care should be taken not to overload the armature of the motor.

A common error is selecting a regulator of insufficient capacity. If the current required to operate the motor at full speed with no resistance in circuit is greater than the rated capacity of the rheostat, overheating of the resistance is certain to result. If, on the other hand, the current required to operate the motor at full speed with no resistance in circuit is less than the rated capacity of the rheostat, no over-heating will occur, but it will not be possible to secure the full 50-per-cent speed reduction that the rheostat is usually designed to give with all resistance in circuit.

Fig. 6.—Alternating-Current Polyphase Speed Regulator.

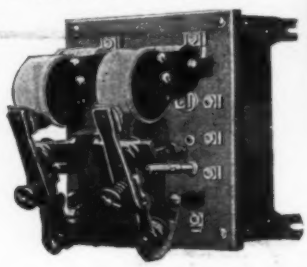


Fig. 8.—Double-Pole Magnetic Switch.

There are two ways for obtaining speed regulation of alternating-current motors: by primary control, which consists of varying the stator potential by means of a compensator or resistance in the primary circuit of the motor; and secondary control, by means of a resistance in the rotor circuit of the motor. Speed control by means of compensators or resistance in the primary circuit of polyphase motors is inefficient and expensive and is never used except in very special cases. For this reason squirrel-cage motors are used with fans *only* when a constant speed is desired. The best method for obtaining varying speeds is with the slip-ring induction motor with a variable rotor resistance, the losses in this case, which are necessary to obtain the reduced speeds, being external to the motor itself.

These regulators have one set of contacts and a pivoted lever with sliding shoe which is free to stand on any intermediate position. Regulators for slip-ring motors (see Fig. 6) have three sets of contacts and a three-armed lever, each arm carrying a sliding shoe, and which may be also left on any contact indefinitely. The regulator front is mounted directly upon an iron frame which contains the regulating resistance.

The sliding-contact type of regulator should not be used with motors of more than 50 horsepower since, above these capacities, the arcing on sliding contacts becomes too severe. With larger motors, multiple-switch regulators should be used.

Fig. 7.—Watson Ventilating Fan.

For installations in flour mills, textile mills, or any place where the air is at all times laden with flying particles, an inclosed type of regulator for fan service is better, as it prevents such material coming in contact with current-carrying parts. The drum type of regulator is completely inclosed. Renewable copper segments are mounted upon a cylinder which is brought into contact with stationary fingers by a rotary motion of the shaft of the cylinder. The secondary resistance is star-connected, with an equal section in each phase, and the sections of resistance in each phase are short-circuited alternately. The resistance is mounted in frames separated from the drums and in

most cases the cast-grid type is employed.

Most of the ventilating fans in use are of such a size as can be driven by small motors: 0.2, 0.25, 0.5, 0.75, 1, 1.5, 2, 3 and 5 horsepower, one familiar type of which is shown in Fig. 7. But fans used for heating plants, for moving air and gases from mines, for planing mills, etc., require motors of considerable size—10, 25, 50, 75 and 100 horsepower.

Where it is desired to start small fans operated at constant speed located on another floor, remote-control solenoid switches may be used for throwing the motor across the line. These can be actuated by means of a small push-button switch located wherever convenient and connected in the solenoid circuit. The closing of the switch energizes the solenoid and closes the switch. These switches are used frequently with fans driven by single-phase, self-starting motors and squirrel-cage induction motors. Fig. 8 illustrates a double-pole magnetic switch that can be used with alternating-current motors.

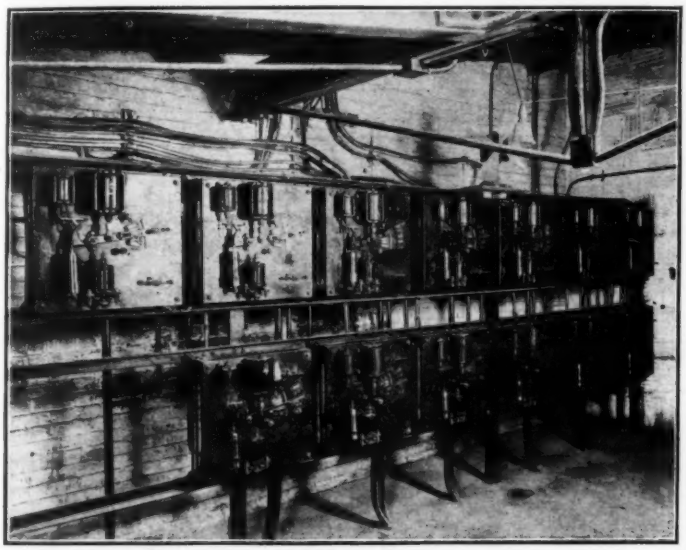


Fig. 9.—Installation of 13 Remotely Controlled Regulators in New York County Court House.

There are many instances where not only remote control of the starting is required but where remote control of the speed regulation is desired and practically essential. In hotels, school buildings, libraries, court houses, etc., where the rooms are used for various purposes and at different periods, a number of fans are used to supply air to the rooms or groups of rooms. The installations in the New York County Court House and Bronx Court House and in several New York schools and hotels are remote-controlled. In the County Court House there are 13 direct-current motor-driven fans in the attic, each fan taking care of one or more court rooms and ante-rooms. The 13 controllers, shown in the illustration, Fig. 9, are located near the fans, but they are automatically operated from the different floors by means of push-button stations. In this installation, each station consists of six buttons, one to start the fans, four to give various degrees of speed and the sixth to stop the fans. When more air is desired in any court room, the fan can be speeded up from that room. The depressing of the button causes the speed-controlling lever on the controller for the fan supplying or exhausting air from that room to move under the action of its solenoid. The indicator at the push-button station indicates the increase in fan speed. The speed-controlling lever of the controllers will remain in any position as desired and the fan will be driven at the speed indicated. In the same way the speed may be reduced by pressing another button and causing the lever to move in the opposite direction.

Wayside Telephones.

Patrol signal-boxes installed with telephone apparatus, and communicating with the nearest exchanges, are being fixed on English roads, so that automobile travelers may, if they desire, order their rooms in hotels ahead, and business men may be able, while on journeys, to communicate with their offices or their homes. The use of these telephones will be free to members except for long-distance calls, for which, of course, the usual trunk charges will be made; and the system will prove of the greatest utility not only for recreation and business but in mishap, for in case of accident or breakdown help can soon be obtained, inasmuch as a patrol will be on duty at each box.

CANADIAN GOVERNMENTAL CONTROL OF NIAGARA ELECTRICITY—IV.

By Frank Koester.

The rates for power and light paid by private users to the Hydro-Electric Power Commission system are practically uniform throughout all the fourteen cities which originally entered into the compact.

Standard Schedule Price for Light and Power.

The Commission, in 1909, requested that the persons responsible for the operation of the various municipal plants taking power through it, should, from time to time, meet and confer respecting matters of common interest. Acting upon this suggestion, several meetings of municipal engineers have been held. One of the questions taken up was the preparation of a base schedule of charges for the sale of electric light and power. Subsequently, standard schedules were prepared, approved by the Commission, and have been adopted by several of the municipalities. This schedule may be said to be the "catalog prices" for light and power. From these prices discounts dependent upon the purchase, costs of power, and other conditions existing in individual municipalities, are given. The base schedules as adopted in 1911 follow.

Lighting Rates.

Class 1—Residence Lighting:

Fixed charge per 100 square feet of area lighted, 4 cents per month.

Additional charge per kilowatt-hour as metered, 3⅛ cents.

To determine the area lighted, the maximum outside dimensions of the building are to be taken, the product multiplied by number of residence floors, and total amount reduced by 10 per cent for walls, etc.; basement and attic not to be included, unless in whole or in part used as living or sleeping rooms.

Class 2—Commercial Lighting:

(a) Stores and theaters, 10 cents per kilowatt-hour for first hour's daily use of installed capacity, and 3.5 cents for each kilowatt-hour above.

(b) Signs and display lighting, same, or flat-rate option.

(c) One-half above rates.

(d) Same, if they are not using power. If they are, the transformer capacity required for connected lighting load may be added to the motor load, and charged at power rates.

(e) Hotels, same as stores. Peak load may be controlled.

Class 3—Flat Rates:

For sign, window and display lighting, $6 per month per kilowatt connected.

The charge of 4 cents per 100 square feet is standard, while the charge per kilowatt-hour varies with the cost of power to the municipalities. The charge of 10 cents for commercial lighting is standard, while the charge for all use above the first hour's daily use varies with the cost of power to

the municipality. The minimum is 3.5 cents and the maximum is 5 cents.

Power Rates.

The following are the yearly base rates for power, together with discounts allowed:

H. P. of Motors or Peak Load	1 to 3	4 to 10	11 to 25	26 to 50	51 to 100	101 up
Flat rates per H. P. per year, based on installed H. P. or maximum demand	$50.00	$48.00	$45.00	$43.00	$41.00	$40.00
Differential rates: Fixed charge per installed H. P. per year or maximum demand	15.00	14.40	13.80	13.20	12.60	12.00
Meter rate per K. W. H. of consumption	....	3.5c	3.0c	2.0c	1.5c	1.25

Class "A"—24 hours unrestricted use—100 per cent of the base rate.

Class "B"—24 hours restricted use—90 per cent of the base rate.

Class "C"—10 hours unrestricted use—90 per cent of the base rate.

Class "D"—10 hours restricted use—66⅔ per cent of the base rate.

Restricted hours:

Oct. 15—Oct. 31: 5:30 p. m. to 6:30 p. m.

Nov. 1—Nov. 30: 5:00 p. m. to 6:30 p. m.

Dec. 1—Jan. 15: 4:30 p. m. to 6:30 p. m.

Jan. 16—Feb. 15: 5:00 p. m. to 6:30 p. m.

A discount is given by different municipalities, ranging from 0 to 33⅓ per cent, according to the cost to the municipality. For instance, the municipalities of London and Woodstock have provided for discounts of 10 per cent. In addition, a discount of 10 per cent will be allowed for payment before the 15th day of the month, on which day the account becomes due.

If the consumer uses power in any higher class than that under which he is rated, he is considered automatically transferred to the new class for the balance of the term of contract.

These rates as paid by the private consumer, do not, however, represent the full cost of the power consumed, which is considerably higher. A peculiar condition of affairs is found in the working out of the Hydro-Electric Power Commission's plan, for in some cities the excess in the real cost of the power over the price at which it is sold to the public is met out of the general tax fund, while in others, the rates are adjusted so that certain users pay an unduly high price, and the surplus that remains is turned into the general tax fund.

In cities where the consumption of light is large, the rates for power are maintained at a low figure and no deficit occurs, since the very high profit on the lighting enables power to be sold at a figure far below its true value. But in cities where the consumption of light is not proportionately large, the users of power who are getting their electricity at a lower figure than its true value, are being favored at the expense of the taxpayers.

The power as delivered to the cities by the Hydro-Electric Power Commission is distributed to the private users over the distributing lines belonging to the cities themselves, such systems of distribution being erected by the cities subsequent to the introduction of the Hydro-Electric service, or acquired by the cities from companies previously owning the system.

A large part of the cost of electricity to the consumer is due to the cost of such local distribution systems. For example, in the city of Woodstock, the proportion which the city was assessed to meet the cost of getting the electricity from Niagara to the cities was $155, yet the cost of the city's distributing system amounts to $110,219.43 and in addition to the interest and sinking fund of this, which must be met out of the sale of electricity, there is an annual operating cost of some $20,000 a year, so that the whole cost of electricity has not been half-way met when it reaches the city's doors.

In the city of Toronto, where the local distribution system has already cost $4,950,000, and where the use of power is large compared with the use of light, a large deficit is being accumulated which, it is stated, is being met by funding the interest and the sinking-fund charges. The plan of the Commission seems to be to so adjust charges that when the full amount of power intended to be, is sold, the rate will be such as to wipe out any present deficit. The burdens of the present are thus put upon the shoulders of the future.

The city of Stratford has expended $80,000 on its distributing system, and in addition it was compelled to purchase an existing system at a cost of over $3,000, which must be paid off within ten years. These charges, with operating expenses of upwards of $20,000 a year, must come out of the pockets of the users of the electricity.

The effect of the plan of the Hydro-Electric Power Commission is that while it is not operated for purposes of gain, the cost of electric current from Niagara is as great if not greater than the cost of electric current generated by private companies in the various cities themselves. The rates which the municipalities charge consumers cannot be higher than the rates charged by private companies, as otherwise they would not hold the business, so that the cities in selling current must incur a loss in one form or another, and this loss arises principally from the costliness of the general transmission installation, and from the cost of the local distribution system. That is to say, not being organized for profit, insufficient attention was devoted to the commercial side of the undertaking, with the result that the participating cities are so deeply involved that no relief is possible until the conclusion of the thirty years' time for which the contracts run. Meanwhile the cities must be handicapped by expensive power.

The Hydro-Electric Power Commission aims at a complete monopoly in the distribution of electric current in Ontario, and in pursuing this object does not hesitate to employ the most direct means of competition, and not only does the commission actively compete with private companies, but it has the right by law to expropriate independent companies as well as the property of individuals for its purposes. It is an almost autocratic body, as it cannot be sued in court, and its powers are almost unlimited. The only reason that all competing electric companies are not expropriated is that their properties are so extensive that such action would bankrupt the participating cities.

The whole plan of the commission is carried out with that lack of business foresight and commercial sanity which very often characterizes "governmental ownership," and which, in reality, means the conduct of large affairs by small politicians.

In pursuance of the well advertised policy of conservation of natural resources, a number of our state governments are contemplating action similar to that of the Province of Ontario, since "governmental ownership" has an even more appealing sound to our politicians. Before our governments, either national or state, proceed to utilize our water powers, it is desirable to have the matter thoroughly investigated in all its aspects. Canada furnishes a shining example of the results of governmental ownership, and its system should be thoroughly digested before any important works of our own are undertaken, and particularly so, since of all our powers now in operation, only one-third can successfully compete with steam power plants. This condition may be principally due to a lack of engineering experience, inadequate investigation of drainage area and other features, and inconsistency of construction, leading to extravagance on one hand and insufficient strength of construction on the other, causing the numerous failures of dams and consequent large loss of life and property

The Additions at the Old Deptford Power Station.

In England lately interest has been redirected once more to the early pioneering work of Ferranti in the high-tension field by reason of the completion of additions and alterations at the now historic Deptford station of the London Electric Supply Corporation, whence as long ago as 1889 current was transmitted to London at 10,000 volts. The severe experience through which all concerned in the venture, either as financiers or engineers, had to pass, are familiar to the older school, and they are written in the records, but it is perhaps not remembered by many today that the corporation had even to manufacture its own cables before it could get satisfactory results. Ferranti designed a special cable made up of an inner and outer copper tube forming the two conductors arranged concentrically with each other, separated by a radial thickness of one-half inch of paper insulation, each conductor having a sectional area of 0.25 square inch. The insulation used consisted throughout of paper impregnated under pressure with ozokerite wax. The concentric cable thus formed was made up in twenty-feet lengths, and about 28 miles of it were laid and it ran satisfactorily for years at 10,000 volts in spite of its 7,000 joints. It is stated that considerable lengths of it are still running satisfactorily, and it is claimed as the pioneer of all high-tension paper-insulated cables in the world.

In view of the additions that have been made under the supervision of G. W. Partridge, who has been for many years chief engineer of the system, the character of the service now given will be of interest. They are: (1) The original 85-cycle, 10,000-volt, single-phase system used for lighting purposes; (2) direct-current, three-wire, 460 and 230 volts, used for power and lighting purposes; (3) three-phase, 25-cycle, 6,600-volts, for large power consumers or traction purposes; (4) the single-phase, 6,600-volt, 25-cycle system used for the Brighton Railway. The station is divided into two sections, one for railway traction and power supply, and the other for lighting. Part of the recent equipment is a Westinghouse 2,000-horsepower motor generator set, the motor of which is driven from the three-phase, 25-cycle system on the traction side and drives a generator giving single-phase, 10,000-volt, 85-cycle current. By this means both sides of the generating station can be connected together when required, and two new 10,000-horsepower turbines, used at their maximum efficiency and capacity. This set, besides being used at times of light load is actually used at times of peak load in the lighting section with the rest of the lighting generators in parallel with it, and although the motor-generator is fitted with a Tirrill regulator this one set enables the pressure of the whole of the lighting section to be kept absolutely constant, all irregularities being apparently taken care of by the motor-generator.

On the modern side of the Deptford station there is a traction switchboard controlling four 2,500-kilowatt reciprocating sets and the two turbines, driving 1,500-kilowatt, three-phase generators. The switchboard controlling the four reciprocating sets is divided into three galleries, and the turbine switchboard at the other end is divided into four galleries. From this board are connected four traction single-phase feeders for the railway service and five three-phase feeders for power supply to factories. The turbine board has the oil switches and group switches controlling the turbines placed at the top gallery, whilst the oil switches controlling the feeders are in the lowest gallery. The high-tension conductors are laid out in such a way that each conductor and isolating switch is inclosed in an earthed shield. It is thus found that no cleaning is required; that live conductors cannot be touched or short-circuits caused by rats or other live animals; that any arc that may be set up is not liable to short-circuit all three phases. The series transformers are clamped outside the earthed covering, thereby making almost impossible a failure in this part of the system. Heavy short-circuits which before now have broken insulators due to the repulsion between conductors, can in no way affect this system. It is also claimed as another advantage that isolating switches are locked in the "on" and "off" positions.

Several special interlocking devices are used on the traction board. Attendants cannot get at the key of the isolating switches without switching off the oil switch of the main generator, thus automatically preventing the isolating switches from being opened under current. By means of pilot lamps the attendant on the control board can see the exact position of the isolating switches. The lamp will only indicate if all three phases are in the "on" or "off" position.

The generator and group switches are motor-driven capable of carrying a current of 2,000 amperes and breaking, at the moment of short-circuit, 40,000 amperes. Owing to the enormous currents given by turbo-generators on short-circuit, reactance coils are installed to reduce the current and prevent undue stress on the windings of the generators, etc. The reactance coil used in connection with the railway supply has a reactance of about four per cent and is designed to withstand a short-circuit current of 10,000 amperes. It weighs about fifteen tons. The two turbines are of the Parsons impulse, reaction type and the 7,500-kilowatt generators by Brown-Boveri Company are specially designed to give either a single or three-phase supply. The boiler equipment comprises 22 Babcock & Wilcox and ten Paxman boilers, and when the two Babcock boilers now adding are in service, the total capacity will be 760,000 pounds of steam per hour. Condensing water is taken from the Thames, and special type strainers, designed by the staff, and made in the corporation's own workshops, prevent debris from entering. Scrapers have a shaving action on the lower surface of a slowly rotating drum which causes the debris adhering to the perforated surface of the drum to fall into a settling chamber in the bottom of the strainer body for discharge into the river by opening a sludge valve either automatically or by hand.

Stopping Runaways by Electricity.

On the Williamsburg Bridge spanning the East River, in New York City, there has been installed a set of motor-operated gates for stopping runaway horses. The gate, which is in two parts, forms a V-shaped chute, 48 feet in length, when open, into which the frightened horse runs. The narrowing sides of the chute grip the vehicle at the front hubs and bring it to a stop without injuring the animal. A system of electrical signals is employed by the officers on duty to warn the attendant of the approach of a runaway. A 7.5-horsepower motor is used to operate the gates. Many serious accidents have been avoided by the use of this device. Energy for the motor is supplied by the New York Edison Company.

Illuminated Sign to Indicate When a Letter Arrives.

The electric sign has recently been put to a novel use in some of the modern hotels, where, as an additional luxury in the most fully equipped private rooms, an illuminated indicator informs the occupant that there is "mail in the office for you." These words are painted on a small glass sign, so that they are only visible when illuminated by a lamp behind. The circuit of this lamp is connected up to the shutter closing the corresponding pigeon-hole in the letter-rack of the office of the hotel, so that when a letter is placed in the rack the sign in the room is illuminated, and the occupant is informed of its arrival.

New Electrical and Mechanical Appliances

Westinghouse Commutating-Pole Rotary Converters.

Commutating poles as applied to rotary converters, fulfill the same functions and result in the same advantages as in their more familiar application to direct-current generators and motors. As with the commutating-pole direct-current machines, they insure sparkless commutation with a fixed brush position from no load to heavy overloads. It is unnecessary to shift the brushes with change of load, as the commutating winding is connected directly in series with the armature and holds the neutral position stationary; therefore, the brushes are located at all times on the no-load neutral point and no brush-shifting device is supplied. The only difference in the application of the commutating poles to rotary converters, is purely in design. A rotary converter is inherently a better commutating machine than a direct-current generator, as its armature reaction is much less, and consequently the commutating-pole coils have fewer turns.

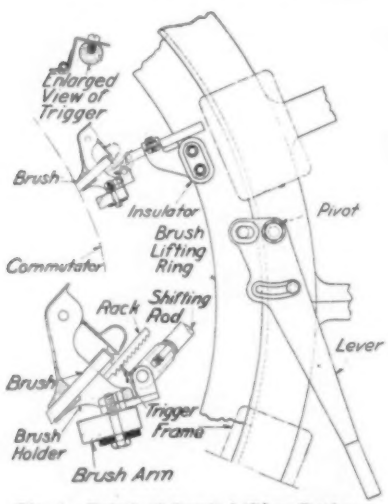


Fig. 1.—Detail of Brush-Lifting Device.

Commutating-pole rotary converters can be arranged for automatic compounding from no load to full load in the same manner as the ordinary machine. They are particularly well adapted for railway service since frequent peak loads, which are very often encountered, can be taken care of without commutation trouble.

The Westinghouse rotary-converter commutating-pole winding is of bar copper bent into the proper form. The inside turns are not insulated but are painted with a heatproof black paint. The outside turns are insulated with tape which is impregnated with an insulating compound. The coil is supported by insulated bolts, and to prevent accidental grounding, an insulating shell is placed between the core and its winding. The core is built up of sheet-steel laminations riveted together under pressure.

The main field poles are also made up of sheet-steel laminations riveted together under pressure. The damper winding, which is separate for each pole in the commutating-pole machine, acts as a starting and damping winding, which insures stable operation in the same manner as the solid-cage winding on a non-commutating-pole machine. The construction of both main and commutating-field windings is such that they dissipate heat very effectively.

The Westinghouse Electric & Manufacturing Company recommends, and has standardized the alternating-current self-starting method on rotary converters. Due to inherent qualities in the commutating-pole converter, it is necessary to raise the brushes from the commutator during the starting period when effected by the alternating current, self-starting method. The simple and convenient arrangement illustrated in Fig. 1, is used for this purpose. In order to raise the brushes for starting, it is only necessary to shift the lever to the other position from the one shown.

An interesting example of this type of converter is illustrated in Fig. 3. This shows a 500-kilowatt, 1,500-volt, commutating-pole converter for high-voltage direct-current railway service. The commutating poles are visible between the main poles and the general field construction of a small converter of this type is well shown.

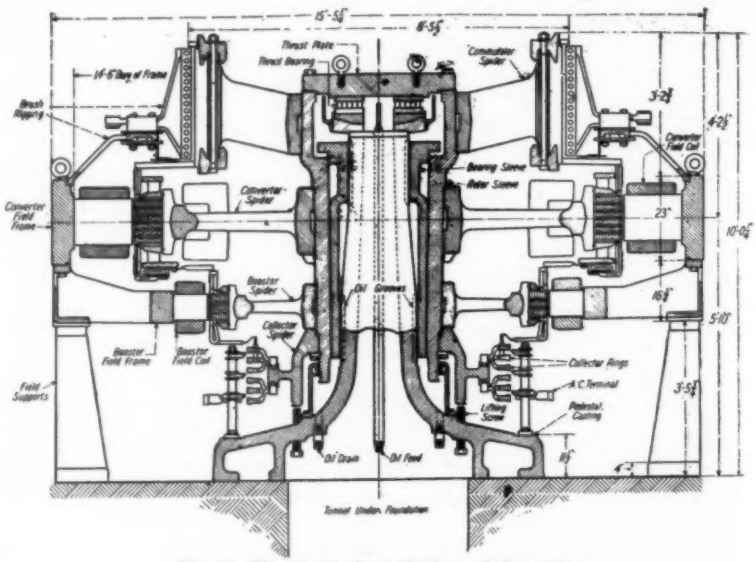


Fig. 2.—Diagrammatical Section of Converter.

Fig. 4 shows a 1,500-kilowatt, 600-volt, commutating-pole, motor-started converter in an industrial plant. A feature of this application is in the electrically operated remote-control switches mounted on the sides of the converter frame, which are operated by a small control switch located on the switchboard. These switches are used for short-circuiting the commutating winding at starting which makes it possible to start up the converter with a starting motor and to throw it on the line without synchronizing.

Two 3,000-kilowatt, vertical, synchronous booster, commutating-pole,

rotary converters have just been built for the New York Edison Company for installation respectively in its Clinton and its Crosby Street substation. These two machines are the largest vertical rotary converters ever constructed and are the only vertical converters ever built involving the synchronous booster and commutating pole features.

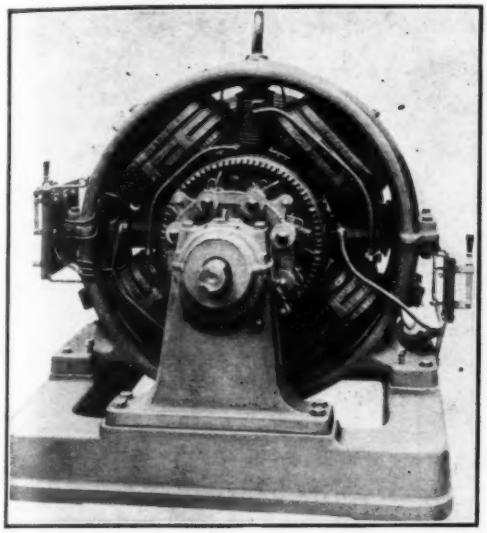


Fig. 3.—500-Kilowatt Commutating-Pole Rotary Converter.

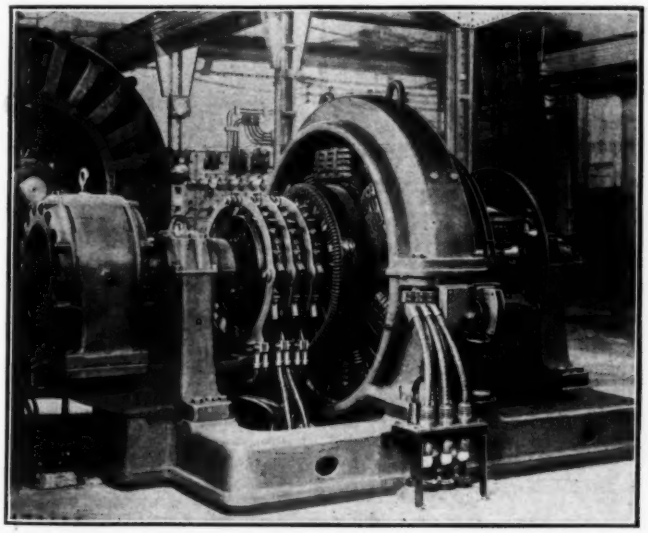


Fig. 4.—1500-Kilowatt Commutating-Pole Rotary Converter with Starting Motor.

The converters deliver a normal direct-current voltage of 270, and are for 25-cycle, six-phase operation. The direct-current voltage variation obtained by virtue of the booster feature is 15-per cent buck and 15-per cent boost from the normal voltage, giving a total direct-current voltage variation of 30 per cent. These machines were made of the vertical type to conform in general construction to the other converters in the substations, all of which are vertical machines.

Fig. 2, sectional drawing, shows the detail construction of the machines. The converter armature and frame are mounted above the booster armature and frame. The commutator is at the top of the machine and the collector rings at the bottom. The armature, illustrated in Fig. 5, consists of a rotary-converter armature of the usual construction mounted on the same shaft with the smaller booster armature, which is connected in series with the converter armature so that when the booster-field excitation is varied, the alternating-current voltage impressed on the converter armature will be decreased or increased accordingly.

The main or converter poles are shunt-wound. The commutating poles, which lie between the main poles, have been so wound that variations in armature reaction introduced by the booster are taken care of. The booster poles are shunt-wound, and the booster field is arranged for hand regulation. Provision is made for effectively cooling the commutator by the insertion of copper heat-radiating vanes in the upper end of each commutator bar. Ample space is provided between commutator necks which extend from the commutator bars to the armature coils, and through these spaces the cooling air is forced by the rotation of the machines. As these machines are to be started from the direct-current end, a brush-lifting arrangement is not necessary.

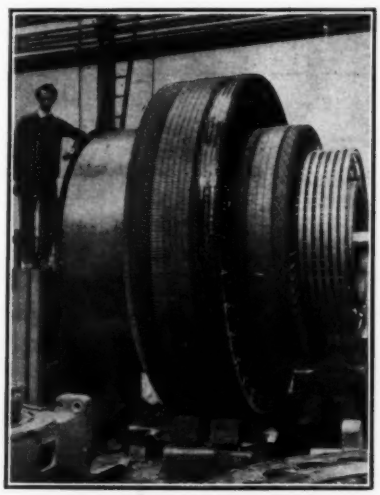


Fig. 5.—View of Armature.

Some of the mechanical constructional features are unique and different from any heretofore used for vertical electrical machines. The pedestal on which the armature rotates, and which is plainly shown in Fig. 2, is a one-piece, hollow steel casting having a large area of base. With this construction a much more rigid structure results than with the usual one wherein a steel pedestal with flange on its lower end is bolted to a cast-iron base. The pedestal is tapered so that the upper bearing is smaller in diameter than the lower one. This facilitates assembly. The bearings proper are babbitted and cast in a sleeve which can be readily taken out of the converter spider for re-babbitting.

A roller thrust bearing is arranged at the top of the pedestal to take the weight of the revolving element. The bearing rests on a plate which has a spherical seat carried on the pedestal so that perfect alinement is asured. The roller bearing can be taken out by removing the top plate of the machine. Six bolts which turn through the lower portion of the pedestal flange are provided. When it is necessary to take off the top plate, these bolts are screwed up until they raise the rotating element a trifle and assume its weight.

Lubrication is effected with a gravity oiling system. The oil is drawn from reservoirs and forced up through the oil pipe in the center of the pedestal. At the top of the pedestal, the oil discharges through a nozzle into a cylindrical chamber within the roller bearing. The pressure on the oil forces it from this chamber out between the bearing rollers into an annular pan surrounding the roller bearing. Oil cannot leave the chamber except through the bearing, and the height of the outlet nozzle and the oil pan rim are such that the bearing rollers always travel in a bath of oil. When the oil overflows from the pan around the roller bearing it passes into an annular chamber just above the upper pedestal bearing. From this chamber its only exit is through oil grooves in the pedestal. While it is passing

through these grooves, the rotating babbitt bearing surfaces take up oil. From the upper pedestal bearing the oil flows down through the chamber around the shaft to oil grooves for the lower bearing similar to those above described. From the lower oil grooves, the oil discharges into an annular reservoir to the lower part of the pedestal from which it drains into a storage reservoir to be circulated again through the lubricating system. An effective oil thrower arrangement is provided at the upper part of the oil space and around the lower part of the pedestal which effectively prevents oil creepage up the shaft.

New Nickel Feed-Through Switch.

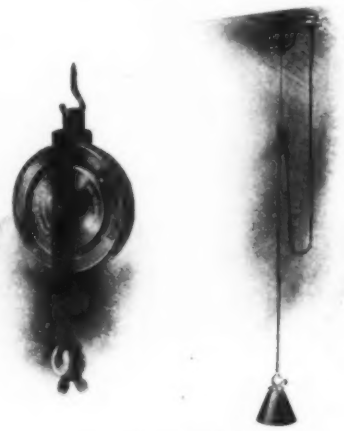
The accompanying full-size illustration shows the new cord or feed-through switch placed on the market by The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. As the name implies, this switch is for installation on the cord used with portable electric devices, such as irons, toasters, disk stoves, chafing dishes, soldering and branding irons, drills and small motor-driven devices. The cord is passed through the switch. The brass shell, which is finished in polished nickel, matches the finish of the heating devices used at the table. This switch provides ready means for opening and closing the circuit. It can be placed on the cord near the device and operated with one hand by simply pushing the button. This saves many steps and eliminates wear on the fixture socket. Its use prevents such embarrassing accidents as the tipping of a dish or cup due to slipping of the hand when attempting to cut off the current by pulling out the plug at the device.

Feed-Through Switch.

The new insulating material developed in the ceramic laboratory of The Cutler-Hammer Manufacturing Company, is used as the body of the switch. This material is tough, withstands hard usage, and holds in permanent alinement the small compact operating mechanism, which is similar to that used in the "Acorn" pendent switch recently marketed. This new switch is approved by the Underwriters' Laboratories and bears their label. The rating is 3 amperes, 250 volts or 5 amperes, 125 volts.

The Gem Cord Adjuster.

The Gem cord adjuster, which is shown in the accompanying illustrations, has an adjustment from one to 15 feet and can be attached to any cord, old or new, without rewiring. There is no wire on the cord and no metal part comes in contact with it. The adjuster carries no current. There is no strain on the rosette or other connection.



Gem Cord Adjuster.

M. B. Austin & Company, Chicago, Ill., has control of the sale of the Gem adjuster in the United States.

An Electric Whistle Wanted.

E. C. Kornhoff, Councilman, 62 Marseilles Place, Garfield, N. J., makes the following enquiry: "Can you furnish names and addresses of concerns furnishing or making electrical whistles suitable for fire alarm in a borough of 12,000 people? We desire to install same on water tank on hill, and operate it from the police station, about one-half mile away. Local current, from Public Service Corporation, 110 volts, alternating, to be used at present."

Control of Heating and Cooking Appliances.

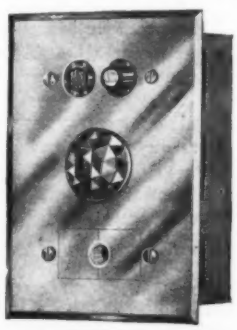
Owing to the convenience of their use, the sale of electrical heating and cooking appliances is steadily increasing. However, like all electrical apparatus, they must be correctly installed to insure the full benefit from their use.

Reference to section 25 of the National Electrical Code shows that electric heaters must be protected by a cutout and controlled by indicating switches; also, it is advisable to connect in multiple with the heater, and between it and the switch, a low-candlepower lamp. This arrangement is to prevent the switch being left in circuit while the heater is not in use. For portable devices, the flexible conductors must be connected to an approved plug and receptacle, the plug of which will be pulled out of the receptacle when an abnormal strain is put on the conductors.

To meet the demand for a practical device which would meet the above requirements, the Machen & Mayer Electrical Manufacturing Company, Seventeenth and Vine Streets, Philadelphia, Pa., has placed upon the market indicating heater receptacles for installation in residences, laundries, factories, etc.

For residences and similar installations, catalogue Nos. 5105, 5110, 5120 and 5125 are used. Their capacity is 5, 10, 20 and 25 amperes, respectively. The devices consist of a suitable switch, lamp and base receptacle, and a flush plug and receptacle. This outfit is mounted in either a steel wall case or cast-iron box and covered by a brass face-plate having a crystal or ruby cut-glass jewel inserted in it. In installations of this kind, it is advisable to run a separate circuit through it from the panel-board. Hence, no fuses are provided in the box.

For industrial installations, such as tailor shops and laundries, where no plug and receptacle is required, catalogue No. 5130 is suitable. It consists of a specially designed box containing a cutout, a switch, a lamp and base receptacle. The cutout can be either of the cartridge or plug-fuse type, and the fuses are accessible by opening the door provided.



Indicating Heater Receptacle.

Catalogue No. 5140 is similar to No. 5130, but in addition it has a plug and receptacle, making it suitable for portable apparatus.

These devices can be furnished for flush or surface mounting. Nos. 5105, 5110, 5120 and 5125 have been approved by the Underwriters' Laboratories. Nos. 5130 and 5140 are recent additions.

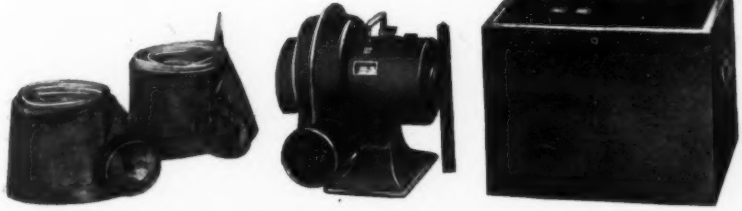
Portable Ventilating Set.

The Diehl Manufacturing Company has developed for special service a portable ventilating set consisting of a blower of the centrifugal type driven by a direct-current motor. The motor is totally inclosed, its frame being cast steel and is placed on the right side of the blower, the steel frame, in conjunction with ball bearings, having the effect of increasing the efficiency of the outfit and decreasing the weight. The motor is bipolar, series-wound, and is so placed that the commutator end is most remote from the blower casing. The brush-holders are mounted directly on the front end cover and the end-cover bolts are set in slots so that there may be adjustment for brush position.

The blower runner which is of the multivane type is mounted directly on the armature shaft, making it with its casing of pressed metal, an integral part of the motor and the whole set self contained. The blower has a horizontal discharge and an outlet 4.375 inches diameter.

The set runs at approximately 2,200 revolutions per minute, and is designed to operate continuously without the temperature rise in any part exceeding 30 degrees centigrade. The specifications call for a temperature rise not to exceed 30 degrees, a delivery of 425 cubic feet of air at a velocity of 4,100 feet per minute, and weight not to exceed 98 pounds. On actual test the set showed a temperature rise of 26 degrees maximum on a ten-hour continuous run, a watt input of 155 against the specification of 185, the delivery of 425 cubic feet of air at the required velocity and a net weight exclusive of box and hose of 49 pounds.

The entire set is varnish-coated, the motor being furnished with a brass handle for portability, and is equipped with two 25-feet lengths of durable canvas hose with couplings for attachment to the blower and to each other. The set is especially useful for portable ventilating work on shipboard, for ventilating rooms, for cooling resistances, etc.



Diehl Portable Ventilating Set.

New Quartz-Tube Mercury-Vapor Lamp.

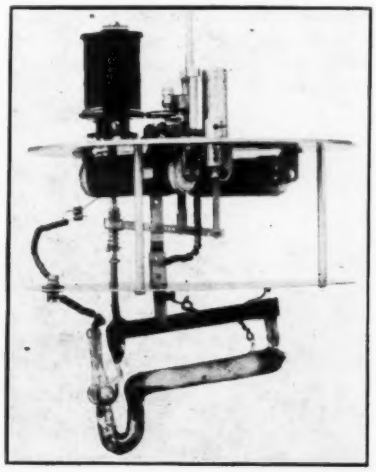
The quartz-tube mercury-vapor arc lamp is very simple in design. The arc

Quartz-Tube Mercury-Vapor Lamp.

tube is about five inches long, the arc proper being about 4 inches long. When the circuit is closed the shunt solenoid, shown in a vertical position at the top of the lamp, is energized, tilting the tube and causing the mercury cathode to make contact with the anode, receding from it as the tube resumes its normal position and forming a very short arc. The pressure in the tube rises very rapidly, however, and pushes the mercury back into the vertical part of the tube, (at the left) permitting the arc to fill nearly the whole of the horizontal part of the tube. The dimensions are so adjusted that when this state is reached the mercury fills its chamber so completely that no further movement of the mercury is possible, thus allowing the arc to develop perpendicular to the surface of the mercury in the vertical part of the tube. Without this feature of design, the cathodic part of the arc would strike the upper surface of the tube causing it to overheat.

The difficulty of making a vacuum-tight seal for the leading-in wires has been solved, so that the problem of the introduction of current is not much more complicated than in the case of an ordinary glass vessel. Instead of a ground joint, tungsten wires are now fused directly into the quartz tube by means of a special seal.

In former designs of quartz lamps, two mercury electrodes were used. This led to serious trouble, owing to the fact that the mercury volatilizes at the anode more rapidly than at the cathode, making it necessary for mercury to drop back through the arc to equalize the mercury levels at the two electrodes. This serious problem of equalizing the mercury levels, which led to the use of all sorts of heat-dissipating devices, such as rows of fins, in the design of previous types of quartz lamps, has been avoided in this new lamp by the use of a solid anode, so that there is only one mercury electrode. This is a great gain, as the heat-dissipating devices require delicate adjustment, they obstruct light, make the tube clumsy, and, above all, cause a serious loss of energy, making this type of design decidedly objectionable. So it was discarded and a solid anode adopted. Moreover, the use of a solid



Mechanism of New Quartz Lamp.

anode results in an increase of 30 to 50 per cent in the efficiency of the lamp, the amount varying but being especially marked in the case of the 110-volt lamp. The use of a tungsten anode eliminates the blacking of the tube while in use.

The quartz-tube mercury-vapor lamp has about double the efficiency of those that have the arc in a glass tube, owing to the possibility of running at a higher temperature and thus concentrating more energy in the arc. A second advantage results directly from this possibility of energy concentration, as it is possible to use short tubes which will operate on 110 and 220-volt, direct-current circuits and be of such length that they can be placed inside of a glass lamp globe. The shortness of the arc, and hence, the small movement necessary to bring the two electrodes into contact by slight tilting, makes possible for this lamp the very simple mechanism shown in the illustrations.

This lamp consumes 85 volts across its terminals on a 110-volt circuit and takes 4 amperes. Its candlepower is 700. Other units with currents down to 1.5 amperes can be built.

The efficiency of the 110-volt lamp across the terminals of the tube is 0.4 watt per spherical candlepower, while, when taking into consideration the loss in the resistance, reflector, and globe the efficiency is about 0.6 watt per spherical candlepower. This is far superior to the efficiency of the French and German lamps for 110-volt circuits and about the same as that of their 220-volt lamps. Yet the field for the 110-volt lamp is much larger than that for the 220-volt lamp.

In addition to the lamp with a shunt-solenoid mechanism, a lamp with series-solenoid mechanism is also being developed.

E. Weintraub, who is developing this lamp in the General Electric Company's research laboratory at West Lynn, Mass., has also developed a vertical lamp of this type.

Bryan-Marsh Sales Conference.

The salesmen and executive department of the Bryan-Marsh Electric Works, Chicago, headed by E. H. Haughton, manager, held a conference and vacation meeting at Piney Ridge Resort, Ludington, Mich., last week. Morning and afternoon sessions were devoted to reports from every section of the country, and during the meeting addresses were made by P. F. Bauder, N. H. Boynton, R. B. Hunter, L. H. Brittin and F. Presbrey. The meeting was successful in every particular, reports for the spring and summer making a highly satisfactory showing and the present outlook indicating a big season.

A Handy Table for Figuring Net Profits.

The Central Electric Company, Chicago, Ill., is distributing a very useful souvenir in the form of a celluloid tablet containing a table for figuring net profits. It is not a simple matter to discover offhand at what price goods should be marked in order that a fixed net profit might be derived. The table issued by the Central Electric Company shows exactly the price that should be set for material or for a job when the cost of doing business figured on sales and the net profit desired are known. The reverse side of the tablet gives a complete table of discount equivalents.

Mack Two-Ton Electric Railway Tower Truck.

The International Motor Company, Broadway and Fifty-seventh Street, New York, N. Y., has recently furnished to the San Diego (Cal.) Railroad Company a gasoline tower truck which is very interesting to electric-railway officials, inasmuch as up to the present time the majority of tower wagons in service by trolley companies are of the electric type.

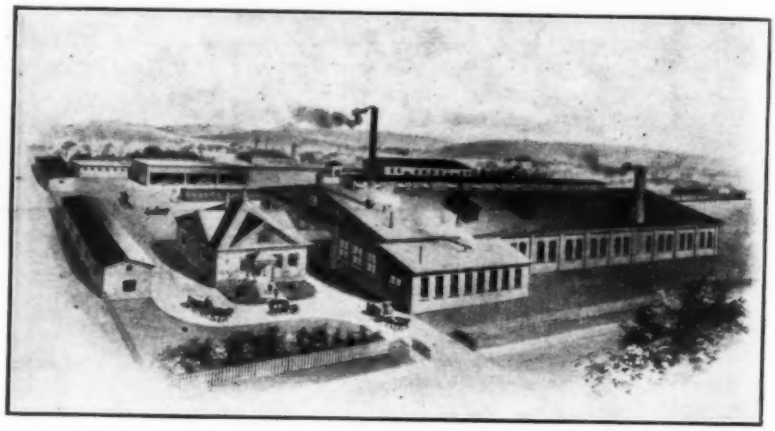
The truck is built on a standard Mack two-ton chassis. The motor is a four-cylinder, four-cycle, L type, the cylinders cast in pairs with heads integralled. The motor is provided with three main bearings. The transmission is of the standard Mack selective-clutch type, operating on the non-sliding principle. A series of interlocking dogs gear into the mesh to give any desired speed. The clutch is of the multiple-disk type, controlled with a pedal interlocking with an emergency brake. The radiator is of a honeycomb design, made particularly to withstand the excessive vibration due to the operation of the tower wagon over Belgian blocks.

The normal speed of the tower wagon is 14 miles per hour, with a provision for increasing this to 16 miles on good roads. The tower is 42 inches wide inside and the sprocket shaft operates back of the tower.

Carbon-Brush Plant.

The accompanying illustration shows one of the most modern, up-to-date carbon-brush plants in the United States, equipped with the latest machinery for the manufacture of the highest-grade brush. It is that of the Speer Carbon Company, St. Marys, Pa.

The Speer Carbon Company manufactures about 40 per cent of the motor and generator brushes used in the United States at this factory and has a very large export trade, which is growing very rapidly. It has just installed a lot of new machinery to take care of the increase in the carbon-brush business and uses every effort to manufacture any special product that is needed in this line.



Factory of Speer Carbon Company, St. Marys, Pa.

The Testing Department is up-to-date, containing all the necessary apparatus for testing the coefficient of friction, the breaking strength, voltage drop, hardness, etc., of carbon brushes.

Sunbeam Conference.

The annual conference of the Sunbeam salesmen of the Western Electric Company was held during the week of July 29 at the Maplewood Beach Hotel near Cleveland, O., simultaneously with the conference of the Brilliant lamp salesmen. The men were addressed by members of the Engineering Department of the National Electric Lamp Association, and by members of their own sales organizations, on topics of commercial and technical interest. On Wednesday afternoon, July 31, there was a hair-raising ball game between the Brilliant and the Western Electric salesmen, in which the latter came off victorious by a score of 8 to 1.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

POMEROY, IOWA.—This town is to have a new electric lighting system.

SWEA CITY, IOWA.—There is a movement on foot for an electric light system. C.

MAQUOKETA, IOWA.—Boulevard lights will be installed in the business district. C.

MADISON, IND.—Plans are being made for the installation of a cluster-light system. S.

SWAINSBORO, GA.—This city has under way plans for the construction of an electric light plant.

SLOAN, IOWA.—The Town Council is preparing to receive bids on a new electric light plant.

PLAINFIELD, N. J.—The Board of Education has made an appropriation for the building of a power plant.

BURBANK, CAL.—G. H. Deacon was the successful bidder for an electric light and power franchise in this city.

SKIATOOK, OKLA.—A bond issue of $3,000 has been authorized for the installation of an electric light system at this place.

LEHIGH, IOWA.—Bonds for $20,000 have been voted here for the establishment of a waterworks system and electric light plant.

DEVIL'S LAKE, N. D.—A franchise has been granted to F. E. Corson to operate a light, water, power and telephone plant at this place.

AURORA, ILL.—Bids are being asked for the new $40,000 addition to the central electric power plant of the traction company at Glenwood.

AUGUSTA, ME.—The Cushnoc Paper Company has increased its capital stock by $50,000, which will be used on improvements to its power plant.

HERMISTON, CAL.—J. A. Ralph has purchased a part interest in the Hermiston Light & Power Company, and the system will be thoroughly overhauled.

MILLTOWN, GA.—Bonds in the amount of $20,000 have been voted here for the purpose of installing a waterworks and electric light system at this place.

NORWAY, IOWA.—The Marion & Cedar Rapids Electric Light Company is considering running a trunk wire to this place from Cedar Rapids to supply power and light. C.

HIBBING, MINN.—The Council has voted for ornamental lights on the principal business streets and is considering the purchase of new machinery for the power plant. C.

SALEM, ORE.—The State Engineer has approved the application of D. P. Donovan to develop 15,000 horsepower at the mouth of Clackamas River. The project calls for an investment of $1,250,000, the money to be secured by stock subscription.

CAMDEN, N. J.—The Councils of this place recently passed a bill authorizing the erection of a municipal electric lighting plant to supply the entire city lighting system.

KANSAS CITY, MO.—The Commerce Power Company has been incorporated with a capital stock of $75,000 by W. T. Kemper, H. C. Schnitzgebel and R. C. Menefee.

GLENCOE, MINN.—The Central Minnesota Light & Power Company has been incorporated with a capital stock of $100,000 to do a general business in electric light and power.

SANTA MARIA, CAL.—The Santa Maria Gas & Power Company has been granted permission to issue bonds in the sum of $50,000, and to extend its service to the city of Arroyo Grande.

EVANSVILLE, IND.—The Public Utilities Company of this place is preparing to install a power substation for the purpose of supplying power to the Evansville-Princeton-Patoka traction line.

LE SUEUR CENTER, MINN.—The Le Sueur County Electric Light & Power Company has been incorporated by Walter D. Hodson and others of Lansing, Mich. The capital stock is $10,000. C.

LAWRENCEBURG, IND.—The Aurora Gas & Electric Light Company has sold its plant to the Indiana Public Service Company. The entire plant will be repaired and put into first-class condition. S.

DALLAS, TEX.—Arrangements are being made for the installation of a special electric lighting system in the business territory of this city. The cost of the proposed system is to be approximately $56,000. D.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company will spend several millions of dollars developing 160,000 horsepower of electricity in a new plant to be erected at Nevens, above Taylors Falls. C.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company has applied for a certificate of public convenience and necessity to operate in the cities of Morgan Hill and Gilroy, and in San Benito County.

BURBANK, CAL.—Articles of incorporation have been filed for the Burbank Electric Light & Power Company, with $20,000 capital stock, by G. H. Deacon, W. Coryell, F. A. Faust, Laura Coryell and Helen M. Deacon.

HODGENVILLE, KY.—A persistent rumor is to the effect that a new electric light plant is to be installed in this city. Emmett Smith, of Chicago, Ill., recently visited Hodgenville and has under way plans for the completion of this undertaking.

INDIANAPOLIS, IND.—The Greater Indianapolis Industrial Association has under consideration a proposition to build a modern power building at Mars Hill for the accommodation of numerous small manufacturing concerns.

CANNELTON, IND.—Cannelton Public Service Company has been incorporated with a capital stock of $10,000 for the purpose of supplying light, heat and power. The directors are Lee Rodman, A. F. Hafele, M. F. Casper, J. T. Hay and G. W. Hufnagel.

EMINENCE, KY.—Extensions of the properties of the Eminence Lighting Company to provide facilities for serving Newcastle and Pleasureville, are to be completed as soon as the sale of the Eminence plant to a holding corporation, the identity of which is kept secret for the present, is consummated.

SPARTANSBURG, S. C.—The Appalachian Power Company has made final arrangements for waterpower rights near Hendersonville for the development of 50,000 horsepower. This will involve an expenditure of $1,500,000. Ladshaw & Ladshaw, of this city, are the engineers in charge of the project.

MASSILLON, O.—The Massillon Electric & Gas Company will construct an electric power plant and system on the shore of Lake Erie at Lorain, which will cost over $500,000. This will serve the towns of Lorain, Elyria, Amherst and other smaller places. R. E. Burger has been placed in charge of this undertaking.

EARLVILLE, ILL.—The Earlville Electric Light Company has been organized with C. H. Cruise as president. The company has made arrangements with H. J. Jaeger of Dyersville to install an up-to-date plant, which at first will be used only for lighting about 30 blocks but later it is expected to enlarge the plant and extend the wires to residences.

WINCHENDON, MASS.—The New Hampshire Water & Electric Power Company has purchased the lines of the Jaffrey, New Hampshire & Troy Electric Light Company. The former company is to run an independent line from the main transmission line in Gardner through Winchendon to Fitzwilliam, where a 66,000-volt transmitter will be installed.

STAUNTON, VA.—The Board of Supervisors of Augusta County have granted right of way for 12 miles of poles to the Staunton Lighting Company, which is under contract to furnish additional power to the Riverside Lighting & Power Company, Waynesboro. The Staunton Lighting Company will also furnish light and power to Fisherville, which is en route.

FREMONT, O.—The Sandusky River Power Company has been incorporated with a capital stock of $9,-

000,000 with F. R. McMullin, of Chicago, as president. The company has under way the construction of an immense dam and power house for the hydroelectric plant, which will harness the waters of the Sandusky River, about two miles south of this place.

DOUGLAS, GA.—This city will expend $15,000 on extensions and improvements to water and light plant. The greater part of the expenditure will probably be on power plant.

CHARLESTON, S. C.—The City Council of this place is agitating the building of a municipal water and lighting plant and petition for a bond issue is being circulated among the taxpayers.

SAN FRANCISCO, CAL.—The Union Iron Works is preparing to erect a power transformer station, plans for which have already been approved, and which is to be one of the finest and most modern of its type on the Coast. The cost of this station with equipment is estimated at $100,000.

MURRAY, UTAH.—The citizens of this place have voted to issue $60,000 worth of bonds for the erection of a municipal power plant at the mouth of the Little Cottonwood Canyon. It is expected that work on the plant will be started in a few weeks and that it will be in operation by the first of the year.

DELANO, MINN.—The Central Minnesota Light & Power Company is negotiating with the village to establish a new electric lighting system here. If consummated the new system would require a complete change of outside wiring and new poles by The Central Minnesota Light & Power Company. For further information the village officers should be consulted.

CROWN POINT, IND.—The Calumet Electric Company has filed articles of incorporation with the secretary of state. The capital stock is $10,000, to be increased later. The object of the corporation is to operate an electric power plant for the purpose of generating and distributing electric current for light, heat and power purposes. The incorporators are A. L. Courtright, W. I. Smith and T. A. Platt. S.

PITTSBURGH, PA.—Plans are under way for constructing a hydroelectric development near Pittsburgh by the American Water Works & Guarantee Company, and its allied interests. Acquisition of water-power sites on the Cheat River, within 50 miles of Pittsburgh, has been going on for some time and it is said that with the property and rights now held, more than 100,000 horsepower can be developed when the installation is complete.

FRANKFORT, IND.—The Wildcat Electric Company has been organized to take over the Adams mill dam near Cutler, and will erect, equip and operate an electro-hydraulic plant to generate electricity to supply electric light and power to Cutler, Sedalia, Rossville and other Indiana towns and to the farmers along the route of the transmission lines. The commissioners of Carroll county have granted the company a franchise to establish poles and string wires along the public highways. The Adams dam will furnish ample water power for an excellent plant. S.

HOSTOTIPAQUILLO (JALISCO) MEX.—The United States Smelting, Refining & Mining Company of Boston, which recently acquired an option on the San Pedro Analco Silver mines in this district, plans to install a hydroelectric plant near the property. The Negociacion Minera de San Pedro Analco, which has given the option, constructed a dam across the Santiago River some time ago as a preliminary part of its plans for installing a hydroelectric plant. This dam will be used by the United States Smelting, Refining & Mining Company if the purchase is consummated. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HUDSON, WIS.—The Wisconsin Telephone Company will begin at once to improve and extend its lines. C.

KINSMAN, O.—The Farmers' Mutual Telephone Company has been incorporated by W. D. Lossee and others.

SCRANTON, PA.—The Suburban Telephone Company of this place has planned extensive improvements to its local plant which will cost over $75,000.

ONAWA, IOWA.—The New State Telephone Company asks for a new franchise and if granted will make extensive improvements in the local system. C.

HOLLY HILL, S. C.—Holly Hill Telephone Company has been incorporated with a capital stock of $15,000. The incorporators are S. J. McCoy, E. Murray, J. F. Felder and others.

DALLAS, TEXAS.—Dallas Automatic Telephone Company has petitioned the City Commission for approval of increase of $200,000 in capital stock and issuance of $250,000 of bonds in addition to $500,- previously authorized for the purposes of enlarging its system.

MISSOULA, MONT.—The Mountain States Telephone Company has plans completed for the extension of its toll lines to Thompson and is only waiting for government permits to start the work. The cost of this work will be about $100,000. C.

WHEELING, W. VA.—Consolidated Telephone Company of Ohio has been incorporated with a capital stock of $500,000. The incorporators are John L. Dickey, Samuel W. Harper, W. C. Handlan, Robert C. Dalzell and H. S. Sands, all of Wheeling.

NEW ORLEANS, LA.—The United Fruit Company intends to build a wireless telegraph station at this place. The station is to be of 50-kilowatt power, long-distance towers having wave lengths of about 1,500 miles. The expenditure will be over $150,000.

ELECTRIC RAILWAYS.

(Special Correspondence.)

COLTON, CAL.—The Pacific Electric Railway Company has been granted a franchise to construct a line on Ninth Street.

RIVERSIDE, CAL.—It is reported that the Southern Pacific Railway Company will soon electrify the Market Street terminal line.

PATERSON, N. J.—The Haledon trolley line will be double tracked from Straight Street to the terminus on upper Market Street in the near future.

LOS ANGELES, CAL.—It is stated that a trolley line will in the very near future be built to Laguna, which is rapidly being inhabited by business people.

CENTRALIA, ILL.—Max Prill, John Langenfeld, Martin Beck and C. C. Baldwin are stockholders in the proposition to build a trolley line on the West Side.

OTTAWA, ILL.—The La Salle County Electric Railway Company has completed the financing of its railway project from Ottawa to Mendota, Earlville, Sandwich and Somonauk, a total of 92 miles.

SPRINGFIELD, MASS.—The officers of the Massachusetts Northern Railway Company have announced that they expect to begin construction on the trolley line from Orange to Millers Falls this fall.

BEAUMONT, TEX.—The Jefferson County Traction Company has filed articles of incorporation with a capital stock of $600,000 for the purpose of building an electric road between Beaumont and Port Arthur.

ST. JOSEPH, MO.—President R. T. Forbes of the Commerce Club has announced that St. Joseph financiers are preparing to underwrite the bonds for the extension of the St. Joseph-Savannah interurban railway to Fillmore, Mo.

BRYAN, TEX.—The Bryan-College Interurban Railroad Company contemplates extending its electric line through the town of Bryan and into the surburb where is located the Allen Academy and Villa Maria Ursuline Convent. D.

MADISON, IND.—S. G. Boyd, superintendent of the Madison Light & Railway Company, announces that the track between Walnut and the Chatauqua grounds will be rebuilt at once and new machinery and new cars will be added.

OSAGE, IOWA.—The city will raise the required bonus of $5,000 for the direct railway to Mason City. Messrs. Lanin and O'Connor, of New Hampton, who are promoting the project, will proceed at once to secure the right of way. C.

FORT WORTH, TEX.—The Real Estate Exchange is interested in the proposed interurban line to Mineral Wells and it is expected that definite action will materialize in the near future. It is proposed to subscribe $70,000 to build the line.

COLUMBUS, O.—It is stated that plans are being considered for the development of the Columbus, New Albany & Johnstown Traction Railway from its present terminus at Gahanna to Wooster, and that Cleveland capital is back of the proposition.

LITTLE ROCK, ARK.—The president of the Board of Trade and other citizens prominent in banking and business are much interested in a movement to construct an interurban line between Little Rock and Memphis, with an extension to Hot Springs, a distance of 200 miles in all.

SUPERIOR, WIS.—The Superior Steel Plant Traction Company has been incorporated with a capital stock of $100,000 by Joseph J. Wirtz, W. C. Hurst and Robert Steward. The purpose of the new company is to build a street car line on Central Avenue and the new steel plant road to the steel plant on the St. Louis River.

MUSKEGON, MICH.—It is stated that Chicago capitalists, including S. M. Weil and Thomas Jacobs, are preparing to finance the construction of

the Manistee-Muskegon railroad. It is also stated that right of way along the lake shore is being contemplated. The present promoters expect to establish an electric interurban line, securing their power from the Grand Rapids-Muskegon Power Company.

BIRMINGHAM, ALA.—Lewisburg, a suburb of Greater Birmingham, is reported taking steps to secure an extension of the Birmingham Railway, Light & Power Company's line.

TULARE, CAL.—The trustees have granted the Big Four Railroad a franchise over the streets of the city for a 34-mile line which will connect Tulare, Visalia, Porterville and Lindsay.

BALTIMORE, MD.—The United Railways & Electric Company proposes to extend its St. Paul Street line from Howard Street to Light Street. William House is president of the company.

MILLBURY, MASS.—A petition to the Worcester Consolidated is being circulated for signatures of Millbury, Sutton and Worcester citizens asking for an extension of the company's lines from the terminus in Bramanville to West Millbury and along the western shore of Lake Singletary. The petition states that the line is a necessity and promises the hearty co-operation of the inhabitants of that region.

MESA, ARIZONA.—The W. K. Palmer Company, engineers, Kansas City, Mo., and the Salt River Valley Electric Railway Company are doing engineering work and making the necessary business arrangements for the construction of this line. Locations and surveys have been completed and the plans and specifications have been prepared for the direct line from Phoenix to Mesa, via Tempe. The Palmer Company is now making surveys for a second line, known as the Southside line, to run from Phoenix to Tempe on the south side of the Salt River.

EAST CHICAGO, IND.—The East Chicago Street Railway Company has filed articles of incorporation with the Secretary of State. The capital stock is $10,000 and is to be increased. The object of the company is to construct, own, maintain and operate street and interurban railroads in and connecting the cities of East Chicago, Gary and Hammond. John Foster, J. S. Persson, Ira C. Wood, Charles W. Chase and Vern R. Case, all of Chicago, Ill., are the promoters. S.

NEW INCORPORATIONS.

DAVENPORT, IOWA.—Midland Electric Fixture Company has been incorporated with a capital stock of $9,000.

OTTAWA, ILL.—Mueller Electric Company has been incorporated with a capital stock of $5,000 to do a general electrical business. The incorporators are John J. Mueller, Jr., Bertha Mueller and J. J. Mueller.

PROPOSALS.

ELECTRICAL APPARATUS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until September 10 for the following articles:

Article	Quantity	Delivery at Navy Yard.	Sch.
Dynamotors, for interior communication circuits.....	3	Mare Island, Cal.	4780
Lantern, battle, electric	100	Mare Island, Cal.	4780
Lantern, deck, electric	80	Mare Island, Cal.	4780
Receptacles, wall, key, bronze	400	Brooklyn, N. Y.	4780
Sets, ventilating	14	Brooklyn, N. Y.	4780

ELECTRIC WIRE.—Sealed proposals will be received by the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until August 27 for furnishing electric wire, as per Canal Circular 723. Blanks and general information from the office of the Purchasing Officer or from any of the assistant purchasing agents located in the large cities.

ELECTRIC CONDUITS AND WIRING AND LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until September 4 for furnishing electric conduits and wiring and lighting fixtures of a three-story building for the post office and court house at Pensacola, Fla.; until September 6 of a four-story building for the post office and court house at Guthrie, Okla.

FINANCIAL NOTES.

The trend of net earnings for a number of railroad systems has shown an improving tendency, net for fifty representative carriers showing a gain of 13 per cent during June. These carriers face the best traffic conditions they have known since 1906-7, because of the excellent crop promise foreshadowed in the Government report last week. Steel market continues firm and active. The increase of nearly 6,000,000 pounds in the visible supply of copper appears to have caused no apprehension, the producers' statement disclosing the fact that domestic consumption keeps on growing.

The meeting of the Edison Company, of Boston, to act on the increase in capital was again adjourned until September 25, pending a decision from the Massachusetts Gas Commission for authority to issue the proposed new stock.

The Dallas Automatic Telephone Company has filed with the Dallas city commission a petition for approval of a charter amendment allowing the Telephone Company to increase its capital stock by $200,000. It was shown that the company also expects to issue $250,000 of the $500,000 bonds provided for. The additional funds will be used, the petition relates, in paying for construction completed and planned "exceeding the original program by nearly fifty-per-cent."

The Cumberland County Power & Light Company, of Portland, Maine, has sold to A. B. Leach & Company, of New York City, $1,700,000 first and refunding five-per-cent bonds, dated August 1, 1912, and due September 1, 1942, but callable at any interest day upon sixty days' notice at 105 and interest. The Cumberland Company has called for payment at 105 and interest at the Windsor Trust Company, New York City, the entire outstanding issue of $947,000 first-mortgage five-per-cent bonds due, September 1, 1940. These bonds are guaranteed principal and interest by the Portland Electric Company. The Cumberland County Light & Power Company controls the Portland Electric, the Lewiston, Augusta & Waterville Street Railway and the Portland Railroad Company.

The Oakland Railways Company, San Francisco, has called for payment at 102 and interest at the Anglo-California Trust Company, New York City, 115 of the collateral trust six-per-cent four-year notes of the company. Notes are guaranteed severally by the Oakland Traction Company, the San Francisco, Oakland & San Jose Consolidated Railway and the East Shore & Suburban Traction. All properties concerned are controlled by the United Properties Company, of California. The authorized issue of the notes, which are dated September 1, 1911, is $2,500,000.

Approval of a $1,200,000 mortgage, dated April 1, 1912, made by the Elizabeth & Trenton Railroad Company to the Logan Trust Company, of Philadelphia, has been given by the New Jersey State Board of Public Utility Commissioners. The Commission also approved issue of $900,000 bonds under the mortgage, proceeds to be used for the rehabilitation, construction and extension of the trolley line between Trenton via Milltown to Elizabeth. Issue of $500,000 bonds by the Riverside Traction Company, was also approved, proceeds to be used for improvements.

The Hattiesburg Traction Company has filed for record a deed of trust with the City Bank & Trust Company, of Mobile, Ala., as trustee, 2,500 $1,000 general-lien sinking fund six-per-cent gold bonds, dated July 1, 1912, and due July 1, 1952, interest payable semi-annually. The trust deed is taken on all holdings and franchises, and the money thus acquired will be used to refund outstanding bonds in the sum of $300,000, for the betterment of their present properties, for the purchase of other property and for the extension of existing lines.

The San Antonio & Rio Grande Valley Interurban Railway Company stockholders meet on October 2, to authorize a $10,000,000 bond issue. The promoters of the Interurban line now about forty-five miles in length, will build an approximately 200-mile extension at a cost of about $25,000 a mile or $5,000,000. The balance of the proceeds of the bond issue will be used for maintenance and to provide working capital.

The Wheeling (W. Va.) Traction Company has called for payment at par and accrued interest September 3, at the Central Trust Company, of New York, the entire issue of $500,000 first-mortgage six-per-cent bonds of the Wheeling Railway Company. The bonds are due September 1, 1922, but callable after September 1, 1912. The Wheeling Traction Company, with its underlying companies is now controlled by the West Penn Traction & Water Power Company, a subsidiary of the American Water Works & Guarantee Company, and the bonds are called for reason of the new ownership. Holders of the Wheeling Railway first 6s are to be given the privilege of subscribing at ninety-seven and interest to a limited amount of first-consolidated five-per-cent bonds of the Wheeling Traction Company. These bonds are secured by a closed first mortgage of $2,500,000.

A meeting of the stockholders of the Shawinigan Water & Power Company will be held in Montreal, September 3, when the shareholders will be asked to authorize the issue of an additional

$5,000,000 of capital stock. The request of the board of directors of the company for this increase is in line with the recent expansion of business of the company and is a forecast of further additions to its hydro-electric plants.

At present the authorized capital of the company is $20,000,000, of which $10,000,000 has been issued. The stockholders will be asked to give authority to the board of directors to issue from time to time such part of the $5,000,000 as requirements of the company may demand. In the last year a new hydro-electric plant, capable of delivering 75,000 horsepower, has been installed. This new development is completed up to a capacity of 30,000 horsepower, which gives that station an aggregate capacity of 85,000 horsepower.

Dividends.

Binghamton Railway Company; a semi-annual dividend of two per cent, payable August 15 to stock of record August 10.

Columbus Edison Company; a quarterly dividend of 1.25 per cent, payable September 1.

Federal Light & Traction Company; regular quarterly dividend of 1.5 per cent on the preferred stock, payable September 1, to stock of record August 15.

Federal Utilities; a quarterly preferred dividend of 1.5 per cent, payable September 3 to stock of record August 15.

The Rochester Railway & Light Company; a regular quarterly dividend of 1.25 per cent on the preferred stock payable September 3, to stock of record August 27.

Reports of Earnings.

LAKE SHORE ELECTRIC.

The Lake Shore Electric Railway reports as follows for June and twelve months ended June 30:

	1912	1911
June gross	$120,914	$113,949
June net	56,620	55,768
Surplus after charges	21,483	21,163
Twelve months gross	587,251	558,586
Twelve months net	228,719	245,457
Surplus after charges	19,845	37,454

NASSAU ELECTRIC RAILROAD.

The Nassau Electric Railroad Company, a subsidiary of the Brooklyn Rapid Transit, reports for the year ended June 30, 1912, as follows

Gross earnings	$4,753,021
Operating expenses	3,148,021
Net earnings	1,605,000
Other income	149,374
Total income	1,754,374
Interest, rentals, and taxes	1,035,675
Surplus	718,699

NEW YORK RAILWAYS.

New York Railways Company reports for the six months ended June 30, 1912, as follows:

Gross	$6,536,945
Net, after taxes	2,080,946
Other income	194,230
Total income	2,275,166
Interest on underlying bonds	1,298,313
Interest on refunding 4s	325,983
Total interest	1,624,296
Balance	650,879

MONONGAHELA VALLEY TRACTION COMPANY.

The Monongahela Valley Traction Company, which was organized in May, 1912, to take over the Fairmont & Clarksburg Traction Company, the Fairmont & Northern Traction Company and the Clarksburg & Western Traction Company, operating in the Fairmont coal district of West Virginia, reports as follows for June, 1912, and the six months ended June 30, 1912:

	1912	1911
June gross	$ 72,400	$ 64,512
June net	42,361	41,446
June surplus	20,507	24,425
Six months gross	387,024	336,324
Six months net	227,882	218,657
Six months surplus	114,775	123,592

SPRINGFIELD RAILWAY & LIGHT CO.

The Springfield (Mo.) Railway & Light Company, a subsidiary of the Federal Light & Traction Co., reports for year ended June 30:

	1912	1911
Gross earnings	$542,626	$477,084
Net earnings	243,172	212,115
Net income	147,094	125,483

The earnings of the company have been showing a steady increase for some time and its properties have been maintained in high condition. The company is now doing much extension and betterment work. Contracts made with the Ozark Power & Water Co., now constructing a 30,000-horsepower hydro-electric plant on the White river south of Springfield, assures an abundance of low priced power for the operation of the Springfield public utilities.

INTERBOROUGH HAS GOOD YEAR.

The report of the Interborough Rapid Transit Company for the year ended June 30, 1912, shows net earnings of $18,198,590, against $17,398,370 the previous year. The income account compares as follows:

	1912	1911
Gross operating rev.	$31,246,392	$29,767,352
Operating expenses	13,047,802	12,368,981
Net operating rev.	18,198,590	17,398,370
Taxes	1,979,431	1,925,090
Operating income	$16,219,159	$15,473,280
Other income	1,305,200	339,915
Total income	$17,524,360	$15,813,195
Interest	11,000,593	10,673,158
Net cor. income	6,523,766	5,140,037
Dividends	5,250,000	3,500,000
Surplus	$ 1,273,766	$ 1,640,037
Previous surplus	6,990,348	5,878,091
Miscellaneous cred.	796,888	261,109
Total surplus	$ 9,061,002	$ 7,779,237
Taxes, etc.	529,742	788,888
P. & L. surplus	$ 8,531,261	$ 6,990,348
Passengers carried	607,244,697	578,154,088

The dividends of $2,250,000 shown on the 1912 report are equal to fifteen per cent on the $35,000,000 stock. It includes the five-per-cent extra dividend declared last June. The dividends of $3,500,000 for 1911 constitute the regular nine-per-cent dividend and an extra dividend of one per cent, declared September 6 and paid October 2, 1911, out of the earnings of the preceding fiscal year.

REPUBLIC RAILWAY & LIGHT.

The Republic Railway & Light Company operating street railways and lighting and power properties in Eastern Ohio and Western Pennsylvania, reports earnings for June, 1912, and the twelve months ended June 30, 1912, as follows:

	1912	1911
June gross	$ 214,736	$ 199,942
June net	85,559	77,559
June surplus	42,585	33,135
Twelve months gross	2,494,656	2,302,122
Twelve months net	994,141	925,296
Twelve months surplus	463,857	408,401

Earnings of Pennsylvania Power Co. are included in both years, from May 1 only, the date in 1912 as of which the securities of this company were acquired.

BROOKLYN RAPID TRANSIT.

The report of the Brooklyn Rapid Transit Company for the fiscal year ended June 30, 1912, shows net earnings of $10,614,491, against $9,820,176 the previous year. The surplus after charges reached a total of $5,863,813, as compared with $5,427,395 in 1911. It is pointed out in the report that on June 30, 1911, the company had expended for construction purposes for which refunding bonds had not at that time been issued, $465,455; to this amount there was added during the fiscal year a net expenditude of $406,522, making a total to June 30, 1912, for which bonds might be issued of $871,977. There were actually authenticated and delivered during the year under the first refunding gold mortgage dated July 1, 1902, four-per-cent bonds of the par value of $482,000, of which $52,000 were issued for refunding purposes, making the net issue for construction $430,000 and leaving an amount of $441,977, for which similar bonds may be issued. This does not include certain capital expenditures, the final reimbursement for which in securities has not yet been determined.

A summary of the income account compares as follows:

	1912	1911
Gross earnings	$23,226,551	$21,986,543
Operating expenses	12,612,059	12,166,367
Net earnings	10,614,491	9,820,176
Other income	317,991	297,524
Total income	10,932,482	10,117,700
Charges and taxes	7,221,260	6,969,221
Surplus	3,711,222	3,148,479
Special appropriation	.....	88,535
Surplus	3,711,222	3,059,944
Miscellaneous items	20,037	.....
Year surplus	3,731,259	3,059,944
Previous surplus	5,427,395	4,781,035
Total surplus	9,158,654	7,840,979
Balance	9,158,654	7,840,979
Reserve, expenses and loss	54,991	170,894
Special reserve	1,000,000	.....
Dividends	2,239,851	2,242,690
P. & L. surplus	5,863,813	5,427,395

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 12.	Aug. 5.
Allis-Chalmers common (New York)	1½	*1¼
Allis-Chalmers preferred New York)	4½	4½
American Tel. & Tel. (New York)	145⅞	145⅝
Commonwealth Edison (Chicago)	139	138½
Edison Electric Illuminating (Boston)	290	297½
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	56	56½
Electric Storage Battery preferred (Philadelphia)	56	56½
General Electric (New York)	182⅝	181⅛
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2⅜	2
Massachusetts Electric common (Boston)	18½	18⅝
Massachusetts Electric preferred (Boston)	94	*94
National Carbon common (Chicago)	122	118½
National Carbon preferred (Chicago)	118	118
New England Telephone (Boston)	152	152
Philadelphia Electric (Philadelphia)	23⅜	23¼
Postal Telegraph and Cables common (New York)	85	88
Postal Telegraph and Cables preferred (New York)	69¼	69
Western Union (New York)	81¾	81½
Westinghouse common (New York)	88¼	82
Westinghouse preferred (New York)	123⅛	123

*Last price quoted.

PERSONAL MENTION.

P. ARTHUR DEMOREST, of Allentown, Pa., recently resigned his position as manager of the Lehigh Telephone Company, due to ill health.

JONATHAN SMITH has recently been appointed general manager and superintendent of the plant of the Conestoga Telephone Company, of Birdoboro, Pa.

M. LUCKIESH, of the Physical Laboratory of theNational Electric Lamp Association, was a visitor to Chicago this week. Mr. Luckeish is one of the committee appointed by the Illuminating Engineering Society to study the effects of glare from paper.

PAUL B. SAWYER, general manager of the Union Electric Company, Dubuque, Iowa, has severed his connection with that company to go to New York to become manager of the Operating Department of the Electric Bond & Share Company. Samuel A. Freshman, of New York, succeeds Mr. Sawyer in Dubuque.

J. P. HORSTMAN, Marietta, O., who for a number of years has been civil engineer with the Parkersburg, Marietta & Inter-Urban Railway Company, and under whose direction most of the interurban mileage was built, has severed his connection with that company to become similarly associated with the street car system of Memphis, Tenn., where Mr. Horstman will make his future home.

FRANKLYN D. WITWER, for some time assistant manager of the Bryan-Marsh Company, Chicago, will become assistant manager of the Brilliant Electric Works, Cleveland, on September 1. Mr. Witwer leaves the Bryan-Marsh organization this week and will be on vacation during the balance of the month. This is the second time Mr. Witwer will be connected with the Brilliant organization. He has been in the incandescent lamp field for a long time, and is one of the most capable men in the business.

WILLIAM HOLLOWAY, for the past five years superintendent of the distributing department of the Kentucky Electric Company, of Louisville, Ky., has been compelled to resign that position because of bad health. Mr. Holloway's resignation takes effect at once and he is to remove to Chicago in the hope of improving his condition. George M. Miller, who has been assistant to Mr. Holloway for three or four years past has been promoted to the post left vacant by his chief.

GEORGE W. ARMSTRONG has resigned as general manager of the Koerting & Mathiesen Company, American distributors for the manufacturers of Excello arc lamps, and will enter a new field of effort that looks very promising for future development. E. W. Phillips, sales manager of the company, succeeds Mr. Armstrong.

THOMAS P. BRADLEY, vice-president and general manager of the Duluth Log Company, Duluth, Minn., spent a few days in Chicago last week in the interests of his company.

H. L. OGG, general manager of the Automatic Electric Washer Company, Newton, Iowa, has been in the hospital since May 1, undertaking a special course of treatment to recover the use of his right hand. Mr. Ogg has been suffering from an X-Ray burn for the last ten years. His many friends and acquaintances will be glad to know that he is now convalescent, and expects to leave the hospital in good shape early in the fall.

F. O. GODFREY has resigned his position as testing engineer for the Commonwealth Edison Company, and has become associated with J. E. Hatman in the Midland Building, Kansas City, Mo. Electrical, mechanical and illuminating engineering will receive the attention of the new firm of Hatman and Godfrey, who will act as both consulting and contracting engineers.

OBITUARY.

ZIBA NICKERSON died at Chatham, Mass., August 1, at the age of 89 years. For many years he had been the oldest telegraph operator in New England, both in years and in service, and was the oldest man in the town of Chatham. He had managed the Chatham telegraph office 55 years, retiring from service last December. In 1855 a telegraph line was built to Cape Cod and Mr. Nickerson soon mastered the art as an operator. When the telegraph company was absorbed by the Western Union Telegraph Company, Mr. Nickerson went with the latter company and had been with it up to the time of his retirement.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.*)

No. 9280. MOTOR-DRIVEN PLOWS.—A firm of leading merchants in a foreign country has informed an American consulate that it desires to secure an agency for a reliable type of American motor-driven plows which can be sold for use on sugar plantations.

No. 9330. ELECTRICAL SUPPLIES.—A business man in Italy, who states that he can furnish the best of references and that he is in an exceptionally good position to sell electrical supplies, informs an American consulate that he desires to receive offers carrying with them exclusive agency rights for a certain territory, from American manufacturers of the following electrical supplies: Lamp brackets, contacts, fuses, interrupters, measuring instruments and meters, arc-lamp carbons, telephone appliances and accessories, bells, and glass and porcelain insulators. Correspondence should be in Italian or French.

No. 9331. ELECTRIC RAILWAY.—Supplementing a previous report, which was published as Foreign Trade Opportunity No. 9000, an American consul in the Far East has forwarded additional particulars regarding the formation of the company to carry out the proposed plans regarding the construction of an electric railway in his district. Copy of the complete report, as well as the name of the person to be addressed, can be secured from the Bureau of Manufactures.

No. 9328. TELEPHONE MATERIAL AND SUPPLIES.—An American consul in a Latin-American country reports that a telephone company in his district anticipates extending its lines between two cities, a distance of about 90 miles, as soon as authorization can be obtained from the Federal Government. A single copper circuit of No. 8 or No. 10 wire will be installed. Copy of the report, containing further details and the names of the persons to be addressed regarding the necessary supplies, can be obtained from the Bureau of Manufactures.

NEW PUBLICATIONS.

REPORT ON EDUCATION.—Vol. II. of the Report of the Uuited States Commissioner of Education for the year ended June 30, 1911, has come from the press. Technological schools and agricultural and mechanical colleges are treated in two chapters of this volume.

NEW YORK COMMISSION.—Vols. II and III of the annual report of the Public Service Commission for the First District of New York for 1910 has come from the press. This contains the orders of the Commission and the statistics of transportation companies.

MAGNETIC OBSERVATIONS.—The United States Coast and Geodetic Survey has published the results of observations made at the Magnetic Observatory in Porto Rico in 1909 and 1910. In addition to the hourly values of the various elements of terrestrial magnetism, the results of observations of earthquakes and magnetic storms are given.

LABORATOIRE CENTRAL D' ELECTRICITE.—Vol. II of the report of the Laboratoire Central D'Électricité, which is carried on in Paris by the Société Internationale des Électriciens, covering the years 1904 to 1911, has been published. It contains a number of valuable papers on electrical subjects by the members of the laboratory staff, of which P. Janet is director.

MICA.—The Department of Mines, Ontario, Can., has published a second edition of its bulletin on "Mica: Its Occurrence, Exploitation and Uses," by Hugh S. de Schmid. This report covers the properties and occurrences of mica, a description of the mica mines and the status of the Canadian industry, statistics of production and exports, commercial applications, the occurrence of mica in foreign countries and an abstract of the laws governing the mining of mica in Canada.

IGNITION OF GAS BY ELECTRIC LAMPS.—In response to numerous requests, the Bureau of Mines, Washington, D. C., has undertaken the study of the ignition of fire damp by electrical equipment. The Bureau has issued Technical Paper No. 23 by H. H. Clark entitled "Ignition of Gas by Miniature Electric Lamps with Tungsten Filaments." This is a preliminary review of tests which have been conducted, showing that the smashing of the bulbs of tungsten lamps may cause ignition under certain conditions.

AERA.—The American Electric Railway Association has started the publication of a monthly entitled *Aera,* the first number of which is dated August. The purpose of this publication is to further the objects of the Association, which are to acquire knowledge relating to the construction, equipment, management and operation of electric railways, to disseminate that knowledge among its members, to improve practice and to establish co-operation among its members and friendly relations with the public. About half of the initial number is devoted to special articles, the remainder being taken up with the Association news and other items of interest.

ANNUAL REPORT OF SEATTLE LIGHTING DEPARTMENT.—The annual report of the lighting department of the City of Seattle, Wash., for 1911, has been published. This contains, in addition to the report, a review of the work since the inception of the municipal electric light and power plant. The compilation has been made under the direction of J. D. Ross, superintendent of lighting. The report makes up a book of 124 pages, and forms a story well worth anyone's reading. It is a review of a big undertaking carried out by honest, efficient and courageous gentlemen. Superintendent Ross may well feel proud of the accomplishment of his organization, and of his ability as an author and editor.

STEAM BOILERS.—The Bureau of Mines, Washington, D. C., has issued Bulletin No. 18, entitled "The Transmission of Heat into Steam Boilers," by Henry Kreisinger and Walter T. Ray. This is a thesis of 172 pages dealing with the investigations of the steam engineering section of the United States Geological Survey, abstracts from the works of others, a general discussion of the laws governing the three modes of heat propagation, and the application of these laws to the design of steam plants. The performance of the boiler has been separated from that of the furnace in these tests, so that definite results could be obtained regarding both the furnace efficiency and the heat-absorbing properties of the boilers.

With the Electrical Manufacturers

The Dayton Electrical Manufacturing Company, Dayton, O., has issued a number of leaflets describing its farm-lighting outfits, launch-lighting outfits, connectors, electric signal horns and its special type B outfit for both lighting and ignition.

The Engineering Department of the National Electric Lamp Association, Cleveland, O., has recently issued Bulletin 3B, which covers the description and performance of Gem metallized-filament lamps, with data on the cost of producing light with them. Copies of this bulletin may be had on request.

Allgemeine Electricitäts-Gesellschaft, Berlin, Germany, has issued a pamphlet describing the street-railway motor U 53. The various parts are illustrated and curves given showing the efficiency, torque and speed with various currents. This motor is designed for 500 volts and also for 220 volts.

National Tube Company, 1106 Frick Building, Pittsburgh, Pa., has issued a bulletin containing an article by William H. Walker on "The Relative Corrosion of Iron and Steel Pipe as Found in Service." This is an abstract of a paper read last year before the New England Water Works Association.

Frank Adam Electric Company, 904 Pine Street, St. Louis, Mo., has issued general catalog No. 18. A variety of electrical material is listed in this catalog, switches, panel boards and cabinets receiving the most attention. This list should be of value to the customer in helping him to select the most appropriate material for the work in hand. The catalog is fully illustrated.

Mica Insulator Company, 68 Church Street, New York, N. Y., has issued a catalog of insulating materials which contains a great deal of data which will interest both the engineer and the purchasing agent. Micanite, linotape and other insulating materials manufactured by this company, as well as vulcanized-fiber products, are listed with full details as to weight, breakdown voltage, sizes, etc.

Charles Bond Company, 520 Arch Street, Philadelphia, Pa., is calling attention to the Crescent belt fasteners, which can be applied to belts of any material, length, width or thickness. The Crescent method employs patented metallic plates binding the ends of the belt and fastened by self-piercing rivets, which cut no holes in the belt but merely separate the fibers. The full strength of the belt is thus preserved.

F. W. Darlington, 50 North Twenty-Third Street, Philadelphia, Pa., has issued catalog No. 50 describing the type P portable and semi-portable electric fountains. These are designed to meet the large and growing demand for luminous effects at banquets and the need of hotels and private residences for permanent artistic effects. Special features of these fountains are the automatic arrangements for constantly changing the water form as well as the color effects. Illustrations are given of the various forms of fountains with dimensions and prices.

General Motors Truck Company, Pontiac, Mich., has issued booklet No. 103, which deals with electric trucks from the standpoint of the power salesman of the central station. The field of the electric truck is discussed, some objections to it answered, and the natural advantages of the electric are stated. Operating and upkeep costs are given and the special advantages of the G. M. C. trucks are stated at some length. While only a limited edition of this booklet has been printed, copies will be sent upon request to central-station solicitors.

Albert J. Kelting, 458 Carroll Street, Brooklyn, N. Y., has issued a catalog entitled "Positive Pressure Blowers." This gives a comparison of the different methods of moving air for high, low and intermediate pressure, with a full description of the Kelting positive pressure blower. The latter is of unique design, operates at moderate speed without the use of gears and gives a steady, non-pulsating blast. It runs quietly and without vibration. Other points in its favor are the absence of valves and the small floor space occupied. This blower is also suitable for vacuum work.

The Central Electric Company, 320 Fifth Avenue, Chicago, Ill., has ready for distribution its mammoth catalog of electrical supplies. This catalog is complete in every detail; is carefully cross-indexed for the discovery of every variety of electrical material, and in addition to its completeness as a listing medium it contains a great deal of descriptive matter that is of practical value to the user of electrical apparatus. The catalog is substantially bound in stiff cloth covers, has been produced at a great expense, and will form a valuable addition to the reference literature available to everyone interested in the purchase of electrical material.

Eugene Dietzgen Company, 166 West Monroe Street, Chicago, Ill., has put upon the market the Ulrich shadowless drafting table, which has been designed to do away with the shortcomings of the ordinary form of table. Electric lamps are mounted so as to throw their rays against the under side of the frosted glass which forms the drawing surface. A soft, clear light without glare is thus obtained, by means of which tracings may be made on drawings or blueprints of any thickness, no matter how faint are the lines on the original drawing. The Premier Ellipsigraph and the fountain ruling pen are two other specialties of this company which will appeal to the draftsman.

The Moloney Electric Company, St. Louis, Mo., is planning to materially extend its field of operation during the coming year. Preliminary to the inauguration of various improvements contemplated by the reorganization the capital stock has been increased from $40,000 to $700,000. The company has interested large capital in its development, and it is expected that the plans will be put in operation in the very near future. The personnel of the office and board of directors is composed entirely of prominent men of St. Louis recognized as factors in both business and social circles. T. O. Moloney, president of the company, is in active charge of its affairs. Associated with Mr. Moloney are James J. Mullen, first vice-president; Henry Ittleson, second vice-president; Hugo Wurdack, secretary; C. L. Hemphill, treasurer. Col. Moses Schoenberg is chairman of the board of directors, and among his associates are David May, L. D. Schoenberg, Nathan Frank, and P. W. Haberman.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is issuing a series of descriptive leaflets on the application of electric motors to paper mill service. Circular

1516, attractively bound in an art cover has been issued on electric locomotives. The locomotives as built by this company jointly with the Baldwin Locomotive Company, of Philadelphia, are described and illustrated in detail. This publication discusses the field of application of the electric locomotives to both steam and electric railways and shows numerous applications on roads throughout the country. "Switchboard Meters" is the title of another attractive publication with an art cover, just issued, which very fully describes the complete line of switchboard meters recently brought out by this company. In addition, the circular contains reprints of papers by Paul McGahan on "Modern Tendencies in the Design of Switchboard Indicating Meters," and "Theory and Performance of Induction Instruments." "Rules for the Selection of Machine-Tool Motors" is the title of a leaflet (2,480) which contains quite a lot of valuable information, relative to the selection of a motor with the proper characteristics for the desired duty.

DATES AHEAD.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

American Electrotherapeutic Association. Richmond, Va., September 3-4.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Pennsylvania Electric Association. Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 4-6.

Eighth International Congress of Applied Chemistry. Washington, D. C., September 4, New York, N. Y., September 6-13.

American Electrochemical Society. Fall meeting in conjunction with Electrochemical Section of International Congress, New York, N. Y., September 7, 9 and 10.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 10-12.

Illuminating Engineering Society, Annual convention, Hotel Clifton, Niagara Falls, Ont., September 16-19.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 23-28.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10 and 11.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

Record of Electrical Patents.

Issued by the United States Patent Office, August 6, 1912.

1,034,408. Electric Motor. Edward M. Barnes, assignor to Advance Mfg. Co., Hastings, Mich. Combination of a driven-member casing and cylindrical motor casing of sheet metal.

1,034,442. Electric Sign. Edward M. Hanley, Rochester, N. Y. Sign character formed of plastic material.

1,034,458. Wire-Stretcher. William O. Hutchins, Vermilion Grove, Ill. Conical body, flat bearing face, screw and nut.

1,034,464. Motor Car. Harold H. Kennedy, assignor to The Waverley Company, Indianapolis, Ind. Motor-car body having compartment for passengers, boxes for supporting body and holding motor and batteries, and an extension.

1,034,510. Circuit-Closing Device. Arthur D. Rizer, assignor to The National Electrical Manufacturing Co., Elgin, Ill. Combination with trolley wire of bar-like frame member.

1,034,518. Hanger for Electrical Apparatus. Albert Scheible, Chicago, Ill. A hanger including an insulator having a depending petticoat and a perforation substantially co-axial with hanger includes a cap, horizontal pin, petticoated insulator, insulating block and supporting member.

1,034,537. Electrical System of Distribution. William A. Turbayne, Lancaster, N. Y., assignor to Gould Coupler Co. Means for regulating voltage of variable-speed generator for car lighting.

1,034,559. Starting Device for Internal-Combustion Engines. Charles G. Adsit, Detroit, Mich. Uses an electric motor.

1,034,561. Electric Distribution System. Vincent G. Apple, Dayton, O. Combination with dynamo, storage battery and ammeter of suitable circuit connections.

1,034,562. Lamp. Vincent G. Apple, Dayton, O. Impervious housing, etc.

1,034,572. Electric-Conduit Fitting. Carl H. Bissell and Floyd Smith, assignors to Crouse-Hinds Co., Syracuse, N. Y. A hollow body with circular opening and notches.

1,034,583. Induction-Coil. John F. Cavanagh, assignor of three-fourths to Lindsley & Allen Electric Co., Providence, R. I. Includes a removable interrupter member.

1,034,584. Lightning-Arrester. F. S. Chapman, assignor to The National Electric Specialty Co., Toledo, O. A vacuum chamber into which electrodes project.

1,034,594. Arc-Lamp. Karl von Dreger, assignor to Gesellschaft fur Verwertung technischer Patente, Bremen, Germany. Contains a plurality of pairs of electrodes.

1,034,596. Electric Switch. Paul Druseidt, Remscheid, Germany. A rotatable switch body and reciprocable but non-rotatable screw.

1,034,609. Method of Fault Location on Electrical Conductors. H. M. Friendly, Portland, Ore. Comprises a measuring instrument.

1,034,620. Electric Stencil-Cutting Machine. E. A. Ivatts, assignor to Compagnie Generale de Phonographes, Cinematographes et Appareils de Precision, Paris, France. The combination with a reciprocating tool, of an electromagnet, an armature oscillating across the pole faces of said electromagnet, and connecting mechanism.

1,034,645. Electrical Ignition Device. H. J. Podlesak, Chicago, Ill. In an ignition system, the combination of a condenser, a primary winding connected in series with it, a secondary circuit including a sparking device.

1,034,686. Headlight. F. Buchanan, Dayton, O. Comprises an arc lamp and a solenoid having a movable core, a fixed arm, a solenoid mounted upon said arm, a bar rigidly connnected to the core of the solenoid, a carbon feed clutch.

1,034,689. Thermostat. T. Chapman, Denver, Colo. Comprises a circuit-closing member actuated by thermostat bar.

1,034,691. Electric Igniter. J. G. Cook, Brooklyn, N. Y. Cable is wound on reel by a spring, opening contacts.

1,034,722. Incandescent Lamp. M. M. Merritt, assignor to General Electric Co. A non-renewable lamp, having means for injuring bulb walls if lamp is heated.

1,034,741. Electric-Light-Cord Adjuster. Theodore Smith, Chicago, Ill. A flexible cord and block with two inclined holes.

1,034,747. Electric Furnace. C. A. Weeks, Philadelphia, Pa. Inclined-flue smelting furnace of great length with distinct zones of temperature.

1,034,760. Mast for Radiotelegraphy. F. G. F. Brackerbohm, Wilhelmsruh, Germany. The combination of a subdivided girder mast and stay wires insulated from the ground.

1,034,762. Means for Packing and Testing Incandescent Electric Globes. A. A. Brown, Luzern, Scotland. Case has one closed end and one end with flaps through which base projects.

1,034,807. Telephone-Call Recorder. Frank A. Lathrop, Portland, Ore. Sender comprises a rotating segmental switch, and recorder is a printing mechanism.

1,034,810. Disk Stove. C. P. Madsen, assignor to Pelouze Manufacturing Co., Chicago, Ill. Combination of special features.

1,034,875. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Comprises substation, line, battery, instruments, three-way condenser, etc.

1,034,883. Lightning Arrester. E. E. F. Creighton, assignor to General Electric Co. Electrolytic cell with concentric electrodes attached to cover.

1,034,887. Process for Regenerating Storage-Battery Plates. Max Deinlein, assignor to Trautmann & Mayer, Munich, Germany. Consists in introducing a zinc member into the electrolyte and then short-circuiting the negative plates with this zinc member.

1,034,890. Cooling Means for Dynamo-Electric Machines. W. A. Dick,

assignor, to Westinghouse Electric & Manufacturing Co. The combination with two dynamo-electric machines of blower members, and inlet parts in casing.

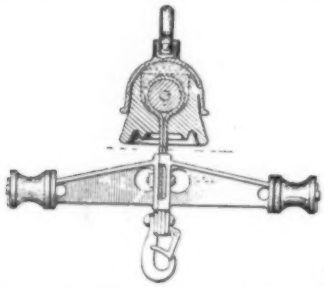
1,034,909. Electric-Conduit Fitting. Bird M. Graybill, Chicago, Ill. Tubular body screws into conduit at both ends, giving inner surface in alinement.

1,034,910. Plug Connector. W. R. Greenway, Brooklyn, N. Y., assignor of one-half to Harry A. Currie, New York, N. Y. Comprises a socket member and plug member, each consisting of two casings.

1,034,917. Means for Constructing Incandescent Lamps. A. S. Knight, assignor to Westinghouse Lamp Co. Combines adjustable holder for supports and adjustable guide for filament.

1,034,923. Vacuum-Tube Lamp. D. McFarlan Moore, assignor to General Electric Co. Contains organic compound of triphenyl methane.

1,034,924. Regulator for Dynamo Machines and Electric Circuits. R. M. Newbold, assignor to The Adams & Westlake Co., Chicago, Ill. Lighting



1,034,518.—Hanger for Electrical Apparatus.

circuits independently controlled by resistance in each, connected to dynamo of variable speed.

1,034,929. Electrical Apparatus. A. B. Reynders and J. E. Mateer, assignors to Westinghouse Electric & Manufacturing Co. Alternate conducting and insulating layers on the core and terminal bushing of a transformer are connected together and to points of the winding to equalize distribution of stress.

1,034,934. Transformer. Otto Schaumberg, assignor to Westinghouse Electric & Manufacturing Co. End plates engage the core sections and bolts clamp them in position.

1,034,936. Instrument Lamp. J. F. Stender, Chicago, Ill., assignor to The Adams & Westlake Company. Comprises lamp, casing and means for mounting.

1,034,945. Electrical Measuring Instrument. John L. Zander, Irvington, N. J. Coil moves between poles of two magnets, one smaller than the other.

1,034,949. Producing Metal Filaments. W. C. Arsem, assignor to General Electric Co. Process consists of mixing refractory metal powder with ductile metal and vaporizing latter by heat.

1,034,952. Electric Water Heater. H. P. Ball, assignor to General Electric Co. Comprises heating element in juxtapositon to restricted passage.

1,034,955. Arc-Lamp Globe. J. T. Beechlyn, assignor to General Electric Co. The globe has reflecting surfaces eccentric to lower electrode.

1,034,964. Magneto-Bell Ringer. E. Bowman, assignor to C. R. Miller, Berlin, Canada. Spring has outer end bent back and extended through slot in armature.

1,034,969. Apparatus for Separating Magnetic Metal from Sand. J. W. Brown, Jr., assignor to The Enterprise Manufacturing Co., Philadelphia, Pa. Has longitudinally reciprocable air-blast pipe extending along separating surface.

1,034,976. Electric Rat Exterminator. J. W. Carmichael, Wellsburg, W. Va. Insulated passageways lead to conductors and movable contact.

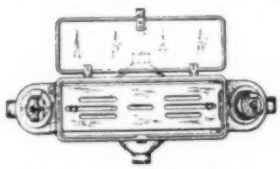
1,035,009. System for Electrically Transmitting Signals. E. Hermsdorf, Brunswick, Germany. Circuit is closed by a bridging pole which passes in close proximity to other poles.

1,035,020. Ground Rod. Charles Lanz, Pittsburgh, Pa. The rod is provided with a collar and wire coil, the cup so formed being filled with solder.

1,035,028. Wire-Stretcher. Peter McMillan, Monango, N. D. A rack and pinion are connected to plates which bear against the post.

1,035,042. Electric Heater. F. C. Perkins, Buffalo, and Mary M. Buck, Franklinville, N. Y.; said Perkins assignor to said Buck. A heating element provided with thermostat.

1,035,045. System of Suspension.



1,034,572.—Conduit Fitting.

Philipp Pforr, assignor to General Electric Co. Combines a sagging cable, a straight suspended wire and sagging intermediate wire.

1,035,060. Electrolytic Cell. Antonio Tommasini, New York, N. Y. Electrodes are arranged under inverted receptacles for collecting hydrogen and oxygen gases.

1,035,061. Electric Chandelier. Samuel Trood, assignor to John H. Dale, New York, N. Y. Insulated contacts on the arms engage with tongues on the base.

1,035,069. Transformer. C. Aalborg, and O. Schaumberg, assignors to Westinghouse Electric & Manufacturing Co. Comprises clamping frames for the core sections.

1,035,115. Automatic Switch for Trolley Roads. O. E. Edwards, Jr., assignor to Cheatham Electric Switching Device Co., Louisville, Ky. Solenoids are controlled through a relay actuated by motor current.

1,035,119. Flaming-Arc Electrode. E. J. Guay, assignor to General Electric Co. An electrode composed of titanium carbid, calcium fluorid, cryolite, and carbon.

Patents That Have Expired.

Following is a list of electrical patents (issued by United States Patent Office) that expired August 13, 1912:

544,278. Electric Rheostat. Francis B. Badt, Chicago, Ill.

544,283. Conduit for Electric Conductors for Railways. Frank L. Capps, Newark, N. J.

544,289. System of Electrical Distribution. Stanley C. C. Currie, New York, N. Y.

544,306. Conductor for Electric Railways. Paul C. Just, Chicago, Ill.

544,312. Trolley for Underground Electric Railways. Myron D. Law, Washington, D. C.

544,313. Traveling Contact Device for Electric Railways. John C. Love, Philadelphia, Pa.

544,318. Multiple-Fuse Switch. Josef Melzer, Saaz, Austria-Hungary.

544,329. Commutator Connection for Dynamo-Electric Machines. Henry H. Wait, Chicago, Ill.

544,331. Globe Netting for Arc Lamps. Ernest P. Warner, Chicago, Ill.

544,332. Electromagnetic Damper for Measuring Instruments. Ernest P. Warner, Chicago, Ill.

544,335. Telephone Switch. Frank R. Whitney, Lewiston, Me.

544,341. Multiple-Switchboard System. Oro A. Bell, Brooklyn, N. Y.

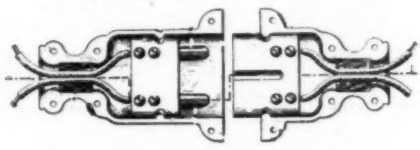
544,343. Magnet-Forming Machine. Orlando P. Briggs, Chicago, Ill.

544,345. Printing Telegraph. Charles L. Buckingham, New York, N. Y.

544,346 to 544,348. Printing Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.

544,351. Relay. Thomas B. Dixon, Henderson, Ky.

544,358. Brush Holder. George J. Junker, Mount Vernon, Ill.



1,034,910.—Plug Connector.

544,361. Construction and Method of Operating Dynamo-Electric Machines. Frederick H. Loveridge, Coldwater, Mich.

544,363. Thermostatic Instrument. Morris Martin, Malden, Mass.

544,365. Synchronism Indicator. Ralph D. Mershon, Pittsburgh, Pa.

544,372. Manufacture of Electric Cables. William R. Patterson, Chicago, Ill.

544,373. Art of Drying Electric Cables. William R. Patterson, Chicago, Ill.

544,374. Art of Drying Cores of Electric Cables. William R. Patterson, Chicago, Ill.

544,383. Electric Grounding Switch. Charles E. Scribner, Chicago, Ill.

544,384. Single-Cord Grounded-Circuit System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill.

544,385. Test Signal for Multiple Switchboards. Charles E. Scribner, Chicago, Ill.

544,386. Telephone-Switchboard Apparatus. Charles E. Scribner, Chicago, Ill.

544,387. Electromagnetic Signal. Charles E. Scribner, Chicago, Ill.

544,388. Telephone-Exchange System. Charles E. Scribner, Chicago, Ill.

544,391. Electric-Railway Conduit System. Lorenzo H. Sherwood, Mount Vernon, N. Y.

544,396. Winding of Dynamo-Electric Machines or Motors. Elihu Thomson, Swampscott, Mass.

544,397. Automatic Adjustable Governor. Edward Thunderbolt, Melbourne, Victoria.